



PROJECT MANUAL
INCLUDING SPECIFICATIONS

FOR

Venetia Valley Buildings G and H Alterations

177 North San Pedro Road
San Rafael, CA 94903

ARCHITECT
SVA Architects, Inc.

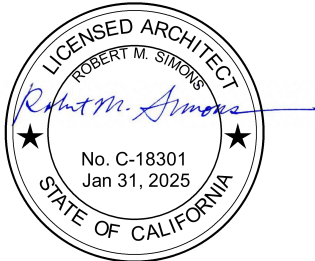
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SVA Project Number:
2023-40119

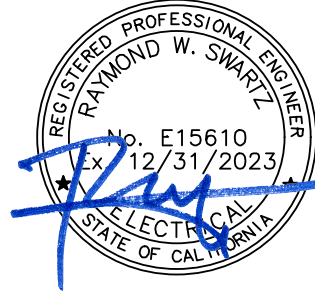
June 21, 2024

SECTION 00 00 01

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Robert Simons, AIA C-18301
Architect, SVA Architects Inc.



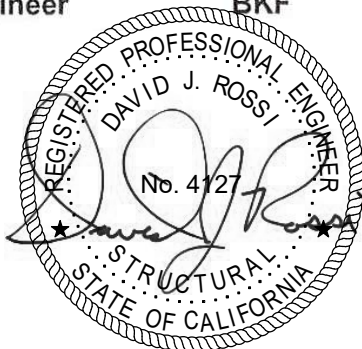
Raymond Swartz E15610
Electrical Engineer tk1sc



Kevin Wong C72285
Civil Engineer BKF



Tjwan Tang M29973
Mechanical Engineer tk1sc



09-11-2023
DATE SIGNED

Blake W. Dilsworth No. 3929
Structural Engineer KPFF

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT

APP: 01-121181 INC:

REVIEWED FOR

SS ☒ FLS ☒ ACS ☒

DATE: 07/02/2024

SECTION 00 01 10

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SECTION 00 72 00

GENERAL CONDITIONS

1 GENERAL CONDITIONS

- A. The General Conditions of the Contract for Construction, AIA Document A201, 2017 Edition, Articles 1 through 15 inclusive, is a part of this Contract, and is incorporated herein as fully as if here set forth.
1. A copy of the General Conditions may be obtained at www.aia.org under "Contract Documents", bottom of page "Store"; by calling 800-242-3837 (option 4); or at www.aiaf.org under "Publications".

END OF SECTION

SECTION 00 73 00

SUPPLEMENTARY CONDITIONS

1.1 REFERENCE TO DIVISION 1 - GENERAL REQUIREMENTS

- A. Where provisions of General Conditions relate to Project administration or work-related requirements of the Contract, those paragraphs are expanded in Division 1 - General Requirements of the Specifications.
- B. General Conditions, Supplementary Conditions and Division 01 - General Requirements contain information necessary for completion of every part of Project.
 - 1. Where items of Work are done under subcontracts, each item shall be subject to these conditions.

1.2 SUPPLEMENTS

- A. The following supplements modify, change, delete from or add to General Conditions of the Contract as indicated in Section 00 72 00 - General Conditions.
- B. Where any part of the General Conditions is modified or deleted by these supplements, unaltered provisions of the modified article, paragraph, subparagraph or clause shall remain in effect.

1.3 ARTICLE 1: GENERAL PROVISIONS

ADD to 1.1 the following definitions:

1.1.9 **Approved:** The terms approved, directed, selected, required, ordered, designated, accepted, acceptable and satisfactory shall require written action by Architect.

1.1.10 **Equal, or Approved Equal:** The terms equal or approved equal shall require requests for substitutions for products or manufacturers not specified; requests for substitutions shall be in accordance with requirements of Section 01 25 00 – Substitution Procedures.

1.1.11 **Furnish:** The term furnish means supply and deliver to Project, unless otherwise defined in greater detail.

1.1.12 **Install:** The term install is used to describe operations at Project, from inspecting and unloading, to completion in place, ready for intended use.

1.1.13 **Provide:** The term provide means furnish and install, complete and ready for intended use, unless otherwise defined in greater detail.

ADD the following to Subparagraph 1.2.1:

1.2.1.2 **Inconsistencies:** In case of an inconsistency between Drawings and Specifications or within other Contract Documents not clarified by addendum, provide better quality or greater quantity of Work in accordance with Architect's interpretation.

1.2.1.3 **Manufacturer Options:** Where manufacturer's offer options for specified products and Contract Documents do not list specific options, provide for best options available and appropriate to applications indicated and clearly indicate options to be selected by Architect with Product Data submittals.

ARTICLE 3: CONTRACTOR

ADD the following to Subparagraph 3.4.2:

3.4.2.1 **Substitutions:** After Contract has been executed, the Owner and Architect will consider formal requests for substitution of products in place of those specified only under conditions set forth in Section 01 25 00 – Substitution Procedures.

ARTICLE 5: SUBCONTRACTS

ADD the following to Paragraph 5.3:

5.3.1 **Materials Suppliers:** For purposes of this Contract materials suppliers shall be considered a Subcontractor regardless of whether they perform their portion of the Work at the site.

ARTICLE 9: PAYMENTS AND COMPLETION

ADD the following to 9.3.2.

9.3.2.1 **Stored Materials:** Payments for materials stored off-site will be made, subject to Owner's approval, if Contractor provides invoice, lien release, certificate of insurance covering stored materials, and stores material in approved, bonded warehouse.

ARTICLE 11: INSURANCE AND BONDS

ADD the following to Subparagraph 11.1.2:

11.1.2.1 **Insurance Amounts:** Amount of insurance shall be as approved by Owner. When additional insurance is required, Owner reserves right to negotiate difference in cost directly with Contractor's Insurance Carrier.

ADD the following to 11.1.3:

11.1.3.1 **Certificate of Insurance:** Furnish one copy of each Certificate of Insurance required for each copy of Agreement.

11.1.3.1.1 Form of certificate shall be an approved certificate which specifically sets forth evidence of all coverage required.

11.1.3.1.2 Furnish to Owner copies of any endorsements subsequently issued amending coverage or limits.

11.1.3.2 Upon receipt of any notice of cancellation or alteration, Contractor shall, within five days, procure other policies of insurance similar in all respects to policy or policies about to be canceled or altered.

11.1.3.2.1 If Contractor fails to provide acceptable policies of insurance, Owner may obtain such insurance at cost and expense of Contractor.

ADD to 11.1.2 the following bond requirements:

11.1.2.1 **Bonds Values:** Provide 100 percent Performance Bond and Payment Bond using AIA Document A312 Performance Bond and Payment Bond, or an approved similar bond.

END OF SECTION

SECTION 01 11 00

SUMMARY OF WORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Project consists of construction of the ***Venetia Valley Buildings G and H Alterations, 177 N San Pedro Rd, San Rafael, CA 94903*** as indicated in Contract Documents.
 - 1. Owner reserves right to remove and retain possession of existing items prior to start of Contract.
 - 2. Removal of hazardous material shall be per separately provided hazardous material abatement report prepared by others. Architect shall not be involved in determination, removal or disposal of hazardous materials.

1.2 REQUIREMENTS INCLUDED

- A. This section includes administrative provisions:
 - 1. Work sequence.
 - 2. Contractors use of premises.
 - 3. Building occupancy.
 - 4. Field engineering.
 - 5. Lines and levels.
 - 6. Regulatory requirements and reference standards.
 - 7. Owner furnished Contractor installed products (OFCI).
 - 8. Owner pre-ordered products.

1.3 WORK SEQUENCE

- A. Coordinate construction schedule and operations with Owner and Architect.
 - 1. Construct Work to accommodate Owner's occupancy requirements during construction period.
- B. Perform construction in phases as indicated.

1.4 CONTRACTORS USE OF PREMISES

- A. Limit use of premises for Work and construction operations and to allow for:
 - 1. Building occupancy.
 - 2. Work by other contractors.
 - 3. Authorized access to restricted areas.
 - 4. Public access to public areas.
- B. Coordinate use of premises and access to site under direction of Owner or Architect.

1.5 BUILDING OCCUPANCY

- A. Building will be occupied during construction for conduct of normal operations; cooperate with Owner to minimize conflict and to facilitate building operations.

1.6 FIELD ENGINEERING

- A. Provide field engineering services; establish lines and levels by use of recognized engineering survey practices.
- B. Locate and protect control and reference points.

1.7 LINES AND LEVELS

- A. Establish lines and levels by use of recognized engineering practices.
- B. Locate and protect control and reference points.

1.8 REGULATORY REQUIREMENTS AND REFERENCE STANDARDS

- A. Regulatory Requirements:
 - 1. Architect has contacted governing authorities and reviewed design requirements of local, state and federal agencies for applicability to Project.
 - 2. Contractor shall be responsible for contacting governing authorities directly for necessary information and decisions bearing upon performance of Work.
- B. Reference Standards:
 - 1. For Products specified by association or trade standards, comply with requirements of referenced standard, except when more rigid requirements are specified or are required by applicable codes.
 - 2. Applicable date of each standard is that in effect as of date on proposal or date on Contract where no proposal is available, except when a specific date is specified.

1.9 OWNER FURNISHED CONTRACTOR INSTALLED PRODUCTS (OFICI)

- A. Select products are to be furnished and paid for by Owner and installed by Contractor:
 - 1. Refer to Drawings and Specifications.
- B. Owner's Responsibilities:
 - 1. Arrange for and deliver shop drawings, product data, and samples to Contractor.
 - 2. Arrange and pay for product delivery to site.
 - 3. Inspect products jointly with Contractor on delivery.
 - 4. Submit claims for transportation damage.
 - 5. Arrange for replacement of damaged, defective, or missing items.
 - 6. Arrange for manufacturer's warranties, inspections, and service.
- C. Contractor's Responsibilities:

1. Review shop drawings, product data, and samples.
2. Receive and unload products at site.
3. Inspect jointly with Owner for completeness and damage.
4. Handle, store, and install products.
5. Finish products as required after installation.
6. Repair or replace items damaged by Work of this Contract.

1.10 OWNER PRE-ORDERED PRODUCTS

- A. Select products have been pre-ordered by Owner:
 1. Refer to Drawings.
- B. Owner has negotiated purchase orders for these products for incorporation into Project.
 1. Purchase orders are assigned to Contractor; costs shall be included into base bid.
 2. Contractor's responsibilities are same as if Contractor negotiated purchase orders.

END OF SECTION

SECTION 01 20 00

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Special administrative and procedural requirements necessary to prepare and process Application for Payment.

1.2 SCHEDULE OF VALUE

- A. Coordination: Coordinate preparation of Schedule of Values with preparation of Contractor's Construction Schedule.
1. Correlate line items in Schedule of Values with other required administrative forms and schedules, including application for Payment forms with Continuation Sheets, Submittals Schedule, and Contractor's Construction Schedule.
 2. Submit Schedule of Values to Architect at earliest possible date but no later than seven days before date scheduled for submittal of initial Application for Payment.
- B. Format and Content: Use Project Manual table of contents as guide to establish line items for Schedule of Values. Provide at least one line item for each Specification Section.
1. Identification: Include following Project identification on Schedule of Values.
 - a. Project name and location.
 - b. Name of Architect.
 - c. Architect's Project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 2. Submit draft of AIA Document G703 Continuation Sheets.
 3. Provide breakdown of Contract Sum in enough detail to facilitate continued evaluation of Application for Payment and progress reports. Coordinate with Project Manual table of contents.
 - a. Provide several line items for principal subcontract amounts where appropriate.
 4. Round amounts to nearest whole dollar; total shall equal Contract Sum.
 5. Provide separate line item in Schedule of Values for each part of Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 6. Provide separate line items in Schedule of Value for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of Work.

7. Each item in Schedule of Values and Application for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in Schedule of Values or distributed as general overhead expense at Contractor's option.
8. Schedule Updating: Update and resubmit Schedule of Values before next application for Payment when Change Orders or Construction Change Directives result in a change in Contract Sum.

1.3 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
 1. Initial Application for Payment: Application for Payment at time of Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: Date for each progress payment is indicated in Agreement between Owner and Contractor. Period of construction Work covered by each Application for Payment is period indicated in Agreement.
- C. Payment Application Forms: AIA Document G702 and AIA Document G703 Continuation Sheets as form for Application for Payment.

USE FOLLOWING FOR LEED CERTIFIED PROJECTS.

1. LEED Progress Reports: With each application for payment, submit LEED action plans as specified in Section 01 35 10.
- D. Application Preparation: Complete every entry on form. Execute by person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
 1. Entries shall match data on Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
 2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Transmittal:
 1. Contractor shall provide ten copies of Application for Payment one week prior to Payment Request ("Draw") Meeting, for review of team members.
 2. Contractor shall provide ten wet signed copies of Application for Payment at Payment Request ("Draw") Meeting.
 - a. Provide each copy with transmittal form listing attachments and recording appropriate information about application.

- b. Copies shall include waivers of lien and similar attachments if required.
- F. Waivers of Mechanic's Lien: With each Application for Payment submit waivers of mechanic's lien from every entity who is lawfully entitled to file a mechanic's lien arising out of Contract and related to Work covered by payment.
- 1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 - 2. When an application shows completion of an item, submit final or full waivers.
 - 3. Owner reserves right to designate which entities involved in Work must submit waivers.
 - 4. Waiver Forms: Submit waivers of lien on forms executed in manner acceptable to Owner.
- G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following.
- 1. List of subcontractors.
 - 2. Schedule of Values.
 - 3. Contractor's Construction Schedule (preliminary if not final).
 - 4. Schedule of unit prices.
 - 5. Submittals Schedule (preliminary if not final).
 - 6. List of Contractor's staff assignments.
 - 7. List of Contractor's principal consultants.
 - 8. Copies of building permits.
 - 9. Copies of authorizations and licenses from authorities having jurisdiction for performance of Work.
 - 10. Initial progress report.
 - 11. Report of preconstruction conference.
 - 12. Certificates of insurance and insurance policies.
- H. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted including but not necessarily limited to following.
- 1. Evidence of completion of Project closeout requirements.

2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement accounting for final changes to Contract Sum.
4. AIA Document G706, Contractor's Affidavit of Payment of Debts and Claims.
5. AIA Document G706A, Contractor's Affidavit of Release of Liens.
6. AIA Document G707, Consent of Surety to Final Payment.
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Completion.
9. Final liquidated damages settlement statement.

USE FOLLOWING FOR LEED CERTIFIED PROJECTS.

10. LEED Final Reports: Submit complete set of LEED Reports as required for submittal to USGBC and as specified in Section 01 35 10.

END OF SECTION

SECTION 01 23 00

ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes a description of alternate work.
- B. Related Requirements:
 - 1. Pricing Documents: Quotation of cost of each alternate.
 - 2. Owner-Contractor Agreement: Alternates accepted by Owner for incorporation into the Work.
 - 3. Sections of Specifications identified in each Alternate.

1.2 PROCEDURES

- A. Alternates will be exercised at Owner's option.
- B. Coordinate Related Work: and modify surrounding work as required to complete Work, including changes under each alternate, when acceptance is designated in Owner-Contractor Agreement.

1.3 ALTERNATES

- A. Alternates: To be determined.
- B. Alternate No. 1: Delete Custom Colors.
 - 1. Work Included in Alternate: Include deduct cost for each line item requiring custom color where color is not indicated on Drawings or Finish Schedule.
 - 2. Work Included in Contract Amount: Include custom color as directed by Architect where color is not indicated on Drawings or Finish Schedule.
 - 3. Sections: List each Technical Section in Project Manual that indicates custom color where color is not indicated on Drawings or Finish Schedule. List to indicate amount in dollars to be saved if Architect selects manufacturer's standard color.
- C. Alternate No. 2:
 - 1. Work Included in Alternate:
 - 2. Work Included in Contract Price:
 - 3. Refer to Section
 - 4. Refer to Drawing No.

END OF SECTION

SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. General: Procedures are described for requesting substitution of unlisted materials in lieu of materials named in Specifications or approved for use in addenda.
 - 1. Provide products listed in Contract Documents, products by manufacturers listed in Contract Documents, and products meeting specified requirements.
 - a. Contract Amount: Base on materials and products included in Contract Documents.
 - b. Where materials and products are listed in Contract Documents, materials and products by manufacturers not listed shall not be used without Owner's and Architect's approval of Contractor's written request for substitution.
 - 2. Purpose: After bidding, substitutions will only be considered where Owner will receive benefit or because specified materials are no longer available due to no fault of Contractor.
 - 3. Purpose: Substitutions will only be considered where Owner will receive benefit or because specified materials are no longer available due to conditions beyond Contractor control.
 - a. Owner benefits either from a Contractor proposed reduction of the Contract amount or from a reduction in Contract time based on acceptance of proposed substitution.
 - b. List proposed cost or time reductions on request for substitution.
 - c. Requests not including a proposed cost or time reduction will not be considered unless Contractor submits supporting information indicating specified materials are not available.
- B. Related Sections:
 - 1. Section 01 60 00: Product requirements.

1.2 SUBSTITUTIONS

- A. Within a period of 35 days after award of Contract, Owner and Architect will consider formal requests for substitutions only from Contractor as specified in 1.1 Summary.
 - 1. Owner and Architect will consider only one request for substitution for each material; where requests are denied Contractor shall be required to provide specified materials.

2. After initial 35-day period, requests will be considered only when a product becomes unavailable through no fault of Contractor; more than one request for substitution will be considered if necessary.
- B. Prior to submittal of second Request for Payment Owner and Architect will consider formal requests for substitutions from Contractor as specified in 1.1 Summary.
 1. Owner and Architect will consider only one request for substitution for each material; where requests are denied Contractor shall be required to provide specified materials.
 2. After payments begin, requests will be considered only when a product becomes unavailable through no fault of Contractor; more than one request for substitution will be considered if necessary.
- C. Submit each request with sequentially numbered "Substitution Request Transmittal" acceptable to Owner and Architect; submit separate request for each product and support each request with:
 1. Product identification with manufacturer's literature and samples where applicable.
 2. Name and address of similar projects on which product has been used, and date of installation.
- D. Submit itemized comparison of proposed substitution with product specified and list significant variations.
- E. Submit data relating to changes in construction schedule.
- F. Note effect of substitution on other work, products, or separate contracts.
 1. Note if acceptance of substitution could require revision of Contract Documents, Drawings, details or Specifications.
- G. Include accurate cost data comparing proposed substitution with product and amount of net change in Contract price.
 1. Include costs to other contractors and costs for revisions to Drawings, details or Specifications.
- H. Substitutions will not be considered for acceptance when:
 1. They are indicated or implied on submittals without a formal request from Contractor.
 2. They are requested directly by a subcontractor or supplier.
 3. Acceptance will require substantial revision of Contract Documents.
- I. Substitute products shall not be ordered without written acceptance of Owner and Architect.
- J. Owner and Architect will determine acceptability of proposed substitutions and reserves right to reject proposals due to insufficient information.

1.3 CONTRACTOR'S REPRESENTATION

- A. Requests constitute a representation that Contractor:
 - 1. Has investigated proposed product and determined it meets or exceeds, in all respects, specified product.
 - 2. Will provide same warranty or longer warranty for substitution as for specified product.
 - 3. Will coordinate installation and make other changes that may be required for Work to be complete in all respects.
 - 4. Waives claims for additional costs that subsequently become apparent.
 - 5. Will pay costs of changes to Contract Documents, Drawings, details and Specifications required by accepted substitutions.

1.4 ARCHITECT'S DUTIES

- A. Review Contractor's requests for substitutions with reasonable promptness.
 - 1. Architect will recommend that Owner accept or reject substitution request.
 - 2. Upon request, Architect will provide cost for changes to Contract Documents, Drawings, details and Specifications required for substitutions.
- B. Notify Contractor in writing of decision to accept or reject requested substitution.

CONTRACTOR'S SUBSTITUTION REQUEST

(Use separate form for each request)

Date: _____ Request No.: _____

TO: **Architect** _____
Phone: _____ Fax: _____

PROJECT: _____ Project No.: _____
CONTRACTOR _____

SPECIFIED ITEM: _____
Section: _____ Page: _____ Paragraph: _____ Description: _____
Drawing Number(s): _____ Detail Number(s): _____
The undersigned request consideration of the following:
PROPOSED SUBSTITUTION: _____

REASON FOR NOT GIVING PRIORITY TO SPECIFIED ITEMS: _____

SAVINGS or CREDIT to OWNER for ACCEPTING SUBSTITUTE: \$ _____
PROJECT COMPLETION CHANGE for ACCEPTING SUBSTITUTE Days _____

Attached data includes description, specifications, drawings, photographs, performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The undersigned certifies that the following paragraphs, unless modified by attachments, are correct:

1. Proposed substitution has been fully checked and coordinated with the Contract Documents.
2. The proposed substitution does not affect dimensions shown on Drawings.
3. The proposed substitution does not require revisions to mechanical or electrical work.
4. The undersigned will pay for changes to the building design, including architectural and engineering design, detailing, and construction costs caused by the requested substitution.
5. The proposed substitution will have no adverse effect on other trades, construction schedule, or warranty.
6. Maintenance and service parts will be locally available for the proposed substitution.
7. The proposed substitution will have no adverse effect on LEED credits (applies to LEED Projects ONLY)
8. The proposed substitution will have no adverse effect on Green Building Requirements where applicable.

The undersigned further states that the function, appearance, and quality of the proposed substitution are equivalent or superior to the specified item.

Attachments: The attached data is furnished herewith for evaluation of the proposed substitution.

☐ Catalog ☐ Drawings ☐ Samples ☐ Reports ☐ Tests ☐ Other: _____

Submitted by: _____

(Firm) _____
(Authorized Legal Signature)

(Address) _____
(Telephone)

For use by the Architect: ☐ Accepted ☐ Accepted as Noted ☐ Rejected: Submit Specified Item

BY: _____
(Authorized Signature)

Date: _____ Remarks: _____

END OF SECTION

SECTION 01 26 00

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: This section specifies administrative and procedural requirements governing Contract modification procedures.
 - 1. Requests for Information (RFI).
 - 2. Change Order.
 - 3. Allowances.
 - 4. Construction Change Directive.
- B. Related Requirements:
 - 1. Section 01 25 00: Substitution procedures.
 - 2. Section 01 30 00: Administrative requirements.

1.2 MINOR CHANGES IN WORK

- A. Architect will issue supplemental instructions authorizing minor changes in Work, not involving adjustment to Contract Sum or Contract Time, on AIA Form G710, Architect's Supplemental Instructions or similar form.

1.3 REQUESTS FOR INFORMATION

- A. Contractor may submit a written Request for Information (RFI) in format approved by Architect relating to perceived inconsistencies and omissions in Contract Documents.
 - 1. A record of RFI's is to be maintained by Contractor along with information regarding origin of request, date of request, and date request was received from Architect. Number RFI's sequentially based on date of request.
- B. Requests for Information shall be used only as a means of obtaining clarification of information not included in Contract Documents and shall not be used to assist Contractor in preparation of shop drawings or other information required by Contract.
 - 1. Contract Documents are intended to contain enough information to show aesthetic and design intent and to provide information such that construction procedures (means and methods) may be reasonably inferred.
 - 2. Contract Documents are not intended to provide specific information related to means and methods of construction nor are they intended to be exhaustive in content.
- C. Contractor shall carefully review requests for information by subcontractors and suppliers to ascertain if information is in Contract Documents prior to submitting a Request for Information to Architect based on requests by others.
 - 1. Contractor may suggest possible solutions to fit Project conditions where appropriate.

- D. Architect reserves right to return RFI's that do not reasonably relate to necessary clarification of intent of Contract Documents and to charge Contractor for time and materials involved in answering RFI's where information is in Contract Documents.
 - 1. RFI's shall not be used as a request for substitutions; refer to Section 01 25 00 – Substitution Procedures.

1.4 CHANGE ORDERS

- A. Owner-Initiated Proposal Requests: Architect will issue detailed description of proposed changes in Work that require adjustment to Contract Sum or Contract Time. If necessary, description will include supplemental or revised Drawings and Specifications.
 - 1. Proposal requests issued by Architect are for information only. Do not consider change order proposal requests as instruction either to stop work in progress or to execute proposed change.
 - 2. Within 10 days of receipt of a proposal request, submit estimate of cost necessary to execute change to Architect for Owner's review.
 - a. Include list of quantities of products required and unit costs, with total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental and amounts of trade discounts.
 - c. Include a statement indicating effect of proposed change in Work will have on Contract Time.
- B. Contractor-Initiated Proposals: When latent or unforeseen conditions require modifications to Contract, Contractor may propose changes by submitting a request for a change to Architect and Owner.
 - 1. Include statement of reasons for change and effect of change on Work. Provide a complete description of proposed change. Indicate effect of proposed change on Contract Sum and Contract Time.
 - 2. Include a list of quantities of products required and unit costs with total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
 - 3. Indicate applicable taxes, delivery charges, equipment rental and amounts of trade discounts.
 - 4. Comply with requirements in Section 01 25 00 - Substitution Procedures if proposed change requires substitution of unspecified product or system for specified product or system.
- C. Proposal Request Form: Use AIA Document G709 for Change Order Proposal Requests; other substitute formats shall be submitted to Owner and Architect for approval prior to use.

- D. Change Order Procedures: Contractor shall be directed to proceed with Work upon Owner's approval of Proposal.
 - 1. Architect will issue Change Order for signatures of Owner and Contractor on AIA Form G701 or similar form, including approved Change Order proposals for that time period.
 - 2. Amounts of each Change Order shall be indicated in each Request for Payment including payment status for each individual Change Order.

1.5 ALLOWANCES

- A. Allowance Adjustment: For Contract items bid based on allowance, submit Change Order Proposal on difference between actual purchase amount and allowance, based on work-in-place.
 - 1. Include installation cost in purchase amount only where indicated as part of allowance.
 - 2. When requested, prepare explanations and documentation to substantiate amounts claimed for work done based on allowances.
 - 3. Submit substantiation of a change in Scope of work claimed in Change Orders related to allowances.
 - 4. Owner reserves right to establish actual quantity of work-in-place by independent quantity survey, measure or count.
- B. Submit claims for increase costs because of a change in scope or nature of allowance described in Contract Documents, whether for purchase order amount or Contractor's handling, labor, installation, overhead and profit.
 - 1. Submit claims within 21 days of receipt of Change Order or Construction Change Directive authorizing work to proceed. Owner will reject claims submitted later than 21 days.
 - 2. Do not include Contractor's or subcontractor's indirect expense in Change Order cost amount unless it is clearly shown that nature or extent of work has changed from what could have been foreseen from information in Contract Documents.
 - 3. No change to Contractor's indirect expense is permitted for selection of higher or lower-priced materials or systems of same scope and nature as originally indicated.

1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: When Owner and Contractor disagree on terms of Proposal Request, Architect may issue a Construction Change Directive per AIA Form G714 or similar form.
 - 1. Construction Change Directive instructs Contractor to proceed with change in Work, for subsequent inclusion in Change Order.
 - 2. Construction Change Directive contains a complete description of change in Work. It also designates method to be followed to determine change in Contract Sum or Contract Time.

- B. Documentation: Maintain detailed records on a time and material basis of Work required by Construction Change Directive. Coordinate scheduling with Construction Manager to allow monitoring by Owner if desired.
 - 1. After completion of change, submit itemized account and supporting data necessary to substantiate cost and time adjustments to Contract.

END OF SECTION

SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This section describes general procedural requirements for ongoing submittals.
 - 1. Schedule of values.
 - 2. Product data and manufacturer's literature.
 - 3. Shop drawings.
 - 4. Samples.
 - 5. Manufacturers' certificates.
 - 6. Excess materials and attic stock.
 - 7. Design build (delegated design) procedures.
 - 8. Deferred approval requirements.
- B. Related Requirements:
 - 1. Section 01 31 00: Project management and coordination.
 - 2. Section 01 32 00: Construction Schedule – Network Analysis.
 - 3. Section 01 32 10: Construction Schedule – Bar Chart.
 - 4. Section 01 40 00: Test reports, manufacturer's field reports, and mock-ups.
 - 5. Section 01 70 00: Manufacturers' instructions.
 - 6. Section 01 77 00: Closeout requirements including Project Record Documents.
 - 7. Section 01 78 00: Warranties.

1.2 GENERAL SUBMITTAL PROCEDURES

- A. Submittals: Transmit each item using form approved by Architect; submit sample to Architect for approval prior to use.
 - 1. Identify Project, Contractor, subcontractor, major supplier.
 - a. Attach sequential identification number for each new submittal.
 - b. Identify each resubmittal using original submittal number and sequential identification clearly indicating item is resubmitted.
 - 2. Identify pertinent Drawing sheet and detail number, and Specification section number as appropriate.
 - 3. Identify deviations from Contract Documents.
 - 4. Provide space for Contractor and Architect review stamps.

5. Contractor: Review and stamp submittals from subcontractors prior to submitting to Architect.
 - a. Review submittals and indicate where conflicts occur with Contract Documents and with work of other subcontractors.
 - b. Return submittals that vary significantly from Contract Documents for correction and resubmittal prior to submitting to Architect.
 - c. Submittals that vary significantly from Contract Documents and that fail to indicate thorough Contractor review prior to submission to Architect will be returned without review.
 - d. cursory review and stamping of subcontractor submittal by Contractor shall not be acceptable.
- B. Initial Schedules: Submit initial progress schedule and schedule of value in duplicate within 15 working days after award of Contract.
 1. After review by Owner and Architect revise and resubmit where required.
- C. Comply with progress schedule for submittals related to Work progress. Coordinate submittal of related items.
- D. After Architect review of submittal, revise and resubmit as required, identify changes made since previous submittal.
- E. Distribute copies of reviewed submittals to concerned persons. Instruct recipients to promptly report any inability to comply.

1.3 TYPES OF SUBMITTALS

- A. General: Project requires various types of submittals to maintain communications, minimize misunderstandings, avoid unnecessary conflicts, and to ensure complete documentation for Project Record Documents.
 1. Maintain complete set of submittals including required revisions.
- B. Construction Schedules: Submit construction progress schedules for Design Team and Owner review and to maintain entire team up-to-date on construction activities.
- C. Schedule of Values: Submit Schedule of Values indicating division of Work, subcontractors to perform work, products being used, and values attributed to each to inform Design Team and Owner.
- D. Action Submittals: Submittals relating to product data and manufacturer's literature, shop drawings, and samples for Design Team review and comment; do not begin fabrication, delivery, or installation until Design Team review is complete.
- E. Information Submittals: Submittals relating to certifications, qualifications, reports, including test reports, and instructions are for information; Design Team may choose to comment but action is not generally anticipated.

1. Manufacturer installation instructions and recommendations shall be considered information submittals.
- F. Design/Build Submittals: Where portion of Work requires design by specialized professionals submit information necessary to ensure work complies with Contract Documents along with certifications signed by qualified professional.
 1. Calculations: Do not submit calculations unless specifically required by Contract Documents; submit calculations required by applicable authorities directly to applicable authorities;
 - a. Submit certification by qualified professional indicating required calculations have been prepared and work conforms to Contract Documents and applicable codes and regulations.
- G. Maintenance Materials Submittals: Compile maintenance information and materials during Work to ensure complete set of documents, maintenance manuals, and operation instructions.
- H. Closeout Submittals: Compile closeout submittals, organize, and submit to Owner prior to or at time of Substantial Completion. Project will not be considered Substantially Complete until closeout submittals have been received by Owner.
- I. Material Safety Data Sheets (MSDS): MSDS will only be reviewed by Architect when submitted to show compliance with LEED certification requirements.
 1. Non-LEED submittals that include material safety data sheets will be returned for resubmittal.

1.4 SCHEDULE OF VALUES

- A. Submit typed schedule on AIA Form G703 or another Owner and Architect pre-approved 8-1/2" by 11" paper format; Contractor's standard media-driven printout will be considered on request. Submit within 15 days after award of Contract.
- B. Format: Table of Contents of this Project Manual, with modifications as pre-approved by Owner and Architect; identify each line item with number and title of major Specification sections.
- C. Include in each line item a directly proportional amount of Contractor overhead and profit.
- D. Revise schedule to list change orders for each Application for Payment.
 1. Submit subschedule for each phase of Work.

1.5 PRODUCT DATA/MANUFACTURERS' LITERATURE

- A. Action Submittals: Mark each copy to identify applicable Products, models, options, and other data; supplement manufacturers' standard data to provide information unique to the Work.

- B. Information Submittals: Include manufacturers' installation instructions only when required by Specifications or specifically requested by Architect.
 - 1. Maintain copy of manufacturer installation instructions and recommendations in Contractor's field office for review.
- C. Product data shall be submitted as electronic PDF files unless otherwise noted or approved by Architect in advance.
 - 1. Where paper copies are permitted submit number of copies Contractor requires, plus one copy to be retained by Architect.
- D. Submit number of copies Contractor requires, plus one copy to be retained by Architect.

1.6 SHOP DRAWINGS

- A. Shop drawings shall be submitted as electronic PDF files unless otherwise noted or approved by Architect in advance.
 - 1. Where prints are permitted submit one reproducible print; minimum sheet size 8-1/2" by 11".
- B. Shop drawings shall be submitted in reproducible format acceptable to Architect and Owner; computerized PDF files will be acceptable unless otherwise directed.
 - 1. Prints: Submit one reproducible print; minimum sheet size 8-1/2" by 11".
 - 2. Prints: Submit three reproducible prints; minimum sheet size 8-1/2" by 11".
- C. Distribution: After review, reproduce and distribute.

1.7 SAMPLES

- A. Submit full range of manufacturers' standard colors, textures, and patterns for Architect's selection.
- B. Submit samples to illustrate functional characteristics of Product, with integral parts and attachment devices.
- C. Coordinate submittal of different categories for interfacing work.
- D. Include identification on each sample, giving full information.
- E. Submit number of samples required by Contractor plus one to be retained by Architect.
 - 1. Maintain one set of approved samples at Project Field Office.

F. Sizes: Provide following sizes unless otherwise specified.

1. Flat or Sheet Products: Minimum 6" square, maximum 12" by 12".
2. Linear Products: Minimum 6", maximum 12" long.
3. Bulk Products: Minimum one pint, maximum one gallon.

G. Full size samples may be used in the Work upon approval.

1.8 MANUFACTURERS' CERTIFICATES

A. Submit certificates, in duplicate in accordance with requirements of each Specification section.

1.9 EXCESS MATERIALS AND ATTIC STOCK

A. Excess Materials: Excess materials shall be considered property of Owner; inform Owner of extent of excess materials and methods required for handling and storage; remove from site excess materials not required by Owner for maintenance stock.

B. Attic Stock: Owner may choose to obtain additional attic stock for maintenance purposes where excess materials are not considered adequate.

1. Owner may require as much as 5% extra materials for maintenance purposes. Exact amount of each material shall be determined by Owner based on following meeting and additional costs determined by Contractor.
 - a. Contractor shall be prepared to order up to 5% extra materials on items that may not be readily available in future such as custom colors, off-shore manufacture, anticipated life span under 5 years, and potential for damage.
 - 1) Do not order extra attic stock until extent is determined and agreed to by Owner including which materials require extra stock and exactly how much those materials will cost including shipping and handling.
 - b. Excess Materials: Furnish excess materials only for materials that have a shelf-life of more than three years.
2. Meeting: Conduct meeting prior to beginning Work to discuss extent of materials Owner would like to receive at Project Closeout for attic stock for maintenance materials; where available include personnel from Owner's maintenance crew.
 - a. Estimate amount of excess materials to be anticipated to be ordered in addition to materials for handling and storage and how those materials will be invoiced and identified regarding material and location in Project.
 - b. Determine area necessary for adequate storage, handling, and identifying excess materials and attic stock and discuss with Owner.
 - c. Submit information regarding equipment necessary for handling of excess materials and attic stock due to weight, size, and storage requirements.

- d. Assist Owner in determining where on-site or off-site additional attic stock for maintenance purposes will be delivered and stored.
3. Additional Costs: After meeting submit to Owner detailed listing of additional costs for each material Owner may like to receive for attic stock and assist Owner in modifying listing to determine acceptable final costs.
 - a. Include unit prices for desired attic stock where excess materials are not adequate for Owner maintenance stock.
4. Substantial Completion: Submit Construction Bulletin at Substantial Completion indicating changes to Contract Amount for attic stock including unit price totals for materials where excess materials are not adequate.
5. Final Completion: Ensure attic stock has been received, identified, cataloged, and stored at locations agreed upon with Owner based on Change Order indicating amounts finally agreed to by Owner.

1.10 DESIGN/BUILD PROCEDURES

- A. Design as Part of Means and Methods of Construction: Select Project components require construction team design as part of means and methods of construction as described in various sections.
 1. Terms commonly used such as Design/Build, Delegated Design, and Design/Assist are applicable to these procedures as determined by law but shall be generally referred to in these documents as Design/Build.
 - a. In general Design/Build includes design by licensed professionals with expertise beyond that allowed under standard architectural licensure, and outside of scope of work of other design professionals on the design team.
 2. Contractor may be required to provide design services as part of construction for specific work defined as design or design-build where special expertise is required that is not available in the Project design team.
 3. Subcontractors, fabricators, and manufacturers may be required to provide design services as part of their work due to special expertise in design services for their specific components, refer to technical sections for Design/Build.
 4. Contractor, subcontractors, fabricators, manufacturers, and suppliers shall be responsible for attachments, anchors, fasteners, adhesives, and connectors suitable to applications unless specific items are listed in Contract Documents.
 - a. Where specific items are listed in Contract Documents Contractor, subcontractors, fabricators, manufacturers, and suppliers shall review and submit comments where items listed are not acceptable.
 - b. Where no comments are received, listed items shall be considered acceptable.

- B. Contractor acknowledges and accepts responsibility for specialty design as part of means and methods of construction, as well as coordination of parties involved to achieve architectural design intent indicated in Contract Documents.
 - 1. Design-build work includes sizing, sequencing, and detailing for construction by professional licensed or registered engineer or design professional with special expertise applicable to portion of Work involved.
 - 2. Design-build work shall be constructed in compliance with building codes and regulations in effect and shall be fit and proper for intended use.
 - 3. Design-build work shall include drawings, specifications, and calculations prepared, stamped, and signed by qualified professional licensed or registered engineer licensed in the Project location as appropriate to design-build work.
 - a. Plans, specifications, and calculations shall be acceptable to Owner, Owner's Representative, and applicable authorities.
- C. Where required by Owner Contractor shall submit copies of current insurance policies covering errors and omissions of persons designing design-build work with deductibles and limits per occurrence as mutually agreed by Owner and Contractor.
 - 1. Provide endorsement to insurance providing for 30-day notice to Owner prior to cancellation or material reduction in coverage.
 - 2. Insurance shall be maintained for not less than applicable statute of limitations for claims of latent defects, if such insurance is not written on an occurrence basis during time design-build work is designed and constructed.
- D. Review proposed layouts with Design Team and with various trades prior to commencing work related to design-build work.

1.11 DEFERRED APPROVAL REQUIREMENTS

- A. Installation of deferred approval items shall not be started until detailed plans, specifications, and engineering calculations have been accepted and signed by Architect or Engineer of Record responsible for Project design.
- B. Deferred Approval Items shall be signed by California registered architect or professional engineer delegated responsibility covering specific work shown requiring approval by Division of the State Architect.
 - 1. Deferred approval items for this Project include but may not be limited to following:
 - a. Translucent Walls and Roofs – Section 08 45 00.
 - b. Telescopic Bleachers – Section 12 66 01.
 - c. Grandstands – Section 13 34 16.
 - d. Hydraulic Elevators – Section 14 24 00.

2. Deferred approval drawings and specifications become part of the approved submittal documents for the Project when they are submitted to and approved by Division of the State Architect.
3. Submit four prints of each drawing. Drawings shall include empty 7" by 9" space on first sheet reserved for Architect to add "General Conformance Block" required for DSA.
4. Submit four copies of calculations, product data and test reports.
5. Identify and specify supports, fasteners, spacing, penetrations, etc., for each deferred approval items, including calculations for each fastener.
6. Submit documents to Architect of Record for review.
7. Deferred submittal documents shall bear stamp and signature of architect or engineer licensed in State of California and responsible for work shown on deferred submittal documents.
8. Architect of Record will forward submittal to appropriate Project Engineer.
9. Review of Project Architect or Engineer of Record is for conformance with design concept shown on Contract Documents. Neither Architect or Engineer of Project shall be responsible for review for correctness of deferred approval items.
10. After review by Architect/Engineer of Record, Architect of Record will forward two copies of submittal to Division of the State Architect for approval.
11. Respond to review comments made by Division of the State Architect and revise and resubmit submittal for final approval.
12. Architect of Record will forward two copies of final revised submittal to the Division of the State Architect for approval.
13. The Division of the State Architect will return one copy of final submittal to the Architect of Record.
14. Architect of Record will forward one copy of evidence of submittal approval by Division of the State Architect for final distribution by General Contractor.

END OF SECTION

SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Description of Project management and coordination including but not necessarily limited to the following:
 - 1. General Project coordination procedures.
 - 2. Coordination drawings.
 - 3. Staff names.
 - 4. Administrative and supervisory personnel.
 - 5. Project meetings.
- B. Related Sections:
 - 1. Section 01 30 00: Administrative requirements.
 - 2. Section 01 79 00: Demonstration and training.

1.2 COORDINATION

- A. Coordination: Coordinate construction operations included in various Specifications sections to ensure efficient and orderly installation of each part of Work.
 - 1. Coordinate construction operations that depend on each other for proper installation, connection, and operation.
 - 2. Coordinate work to assure efficient and orderly sequence of installation of construction elements.
 - 3. Make provisions for accommodating items installed by Owner or under separate contracts.
- B. Prepare memoranda for distribution to each party involved as needed, outlining special procedures required for coordination.
 - 1. Include required notices, reports, and list of attendees at meetings; include Architect and Owner in distribution.
- C. Verify characteristics of interrelated operating equipment are compatible; coordinate work having interdependent responsibilities for installing, connection to, and placing such equipment in service.
- D. Coordinate space requirements and installation of mechanical and electrical work indicated diagrammatically on Drawings.
 - 1. Follow routing shown for pipes, ducts, and conduits as closely as possible; make runs parallel with lines of building.
 - 2. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

- E. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated; coordinate locations of fixtures and outlets with finish elements.
- F. Administrative Procedures: Coordinate scheduling and timing of administrative procedures with other construction activities and activities of other contractors to avoid conflicts and ensure orderly progress of Work.

1.3 SUBMITTALS

- A. Coordination Drawings: Prepare Coordination Drawings for areas where space availability is limited and necessitates maximum utilization of space for components and where separate entities, products, and materials require coordination.
 - 1. Require each subcontractor with items located in ceiling space to furnish coordination drawings of their items to assist in preparation of Contractor's Coordination Drawings.
 - 2. Indicate relationship of components shown on separate Shop Drawings.
 - 3. Indicate required installation sequences.
 - 4. Ceiling Spaces: Take special care to coordinate structure, ceiling systems, equipment located in ceiling spaces, fire protection systems, mechanical systems, and electrical systems.
- B. Staff Names: Immediately after receipt of notice to proceed or immediately after signing of Contract by Owner and Contractor, submit list of principal staff assignments, including superintendent and other personnel in attendance at Project site.
 - 1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone.

1.4 SUPERVISORY AND ADMINISTRATIVE PERSONNEL

- A. Provide supervisory personnel, in addition to Project Superintendent, as required for proper and timely performance of Work and coordination of subcontracts.
- B. Provide administrative staff as required to allow Project Superintendent and supervisory personnel to allocate maximum time to Project supervision and coordination.

1.5 PROJECT MEETINGS

- A. Schedule and administer Project meetings throughout progress of Work:
 - 1. Pre-construction meeting.
 - 2. Progress meetings at weekly intervals.
 - 3. Pre-installation conferences.
 - 4. Coordination meetings.
 - 5. Special meetings.
- B. Make physical arrangements for meetings, prepare agenda with copies for participants, preside at meetings, record minutes and distribute copies within two days to Architect, Owner, participants, and those affected.

- C. Attendance: Job superintendent, major subcontractors and suppliers as appropriate to agenda; Architect, Owner, and Owner and Architect's consultants as appropriate to agenda topics for each meeting.
- D. Suggested Agenda: Review of Work progress, status of progress schedule and adjustments, delivery schedules, submittals, requests for information, maintenance of quality standards, pending changes and substitutions, and issues needing resolution.

END OF SECTION

SECTION 01 35 15

CALGREEN ENVIRONMENTAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Comply with CALGreen environmental requirements related to energy efficiency, water efficiency and conservation, material conservation and resource efficiency, and environmental quality.
 - 1. Comply with specific CALGreen requirements as adopted by authorities having jurisdiction and applicable to Project.

1.2 ENVIRONMENTAL REQUIREMENTS

- A. Mandatory Measures: Comply with CALGreen Mandatory Measures applicable to Project.
 - 1. Design team and construction team are each required to participate to maximum degree possible to achieve CALGreen environmental requirements.
 - 2. Contract Documents are not intended to limit alternative means of achieving environmental requirements.
 - a. Suggestions from Contractor, subcontractors, suppliers, and manufacturers for achieving environmental requirements are encouraged; team approach is also encouraged.
 - 3. Voluntary Tiers: Verify extent of Voluntary Tiers applicability to Project.
 - a. Construction team is encouraged to work with Owner and Design Team to incorporate additional measures as defined in CALGreen Appendixes.
 - b. Contact Owner and Architect regarding extent of intent of Project to reach Voluntary Tiers, additional work necessary to achieve enhanced Voluntary Tiers, and potential costs involved in achieving each Voluntary Tier.
 - c. Construction team is required to achieve Mandatory Measures and Voluntary Tiers as applicable, and to achieve as much as possible without unacceptable cost impact or schedule impact as determined by Owner.
- B. Requirements: Construction team is required to review CALGreen requirements relative to Project related to following.
 - 1. Energy Efficiency: Comply with California Energy Commission requirements.
 - 2. Water Efficiency and Conservation: Comply with requirements for both indoor and outdoor water use.
 - 3. Material Conservation and Resource Efficiency:

- a. Nonresidential Projects: Provide weather-resistant exterior wall and foundation envelope including prevention of landscape irrigation spray on structures (if any) and prevent water intrusion at exterior entries.
 - b. Residential Projects: Seal openings and penetrations in building envelope
Construction Waste:
 - c. Provide construction waste management plan as defined by CALGreen with demolition and construction waste diverted from landfill by recycling or salvage for reuse.
 - d. Nonresidential Projects Building Maintenance and Operation: Provide for commissioning requirements as required by CALGreen including but not limited to testing, documentation and training, testing and adjusting.
 - e. Residential Projects Building Maintenance and Operation: Provide operation and maintenance data as required by CALGreen.
4. Nonresidential Projects Environmental Quality: Comply with following as adopted by authorities having jurisdiction and as applicable to Project.
- a. Fireplaces: Comply with requirement for fireplaces (if any) to be direct-vent sealed-combustion gas type or sealed wood-burning fireplace, woodstove, or pellet stove.
 - b. Mechanical Equipment Pollution Control: Cover duct and related air distribution component openings to prevent dust and debris accumulation.
 - c. Finish Material Pollution Control: Comply with CALGreen requirements for volatile organic compound (VOC) emissions including but not necessarily limited to following (as applicable):
 - 1) Adhesives, sealants and caulks.
 - 2) Paints and coatings.
 - 3) Carpet systems including carpet, carpet cushion, and adhesives.
 - 4) Resilient flooring systems.
 - 5) Composite wood products formaldehyde limitations.
 - d. Filters: Comply with requirements for mechanically ventilated buildings to have air filtration media for outside and return air prior to occupancy.
 - e. Environmental Tobacco Smoke (ETS) Control: Comply with CALGreen requirements for ETS.
 - f. Interior Moisture Control: Comply with California Building Code requirements and CALGreen requirements for vapor retarder at concrete slab foundations and capillary break (aggregate base).
 - g. Building Material Moisture Content: Do not use water damaged building materials, remove and place wet and high moisture content insulation, and do not enclose wall or floor framing when moisture content exceeds 19%.

- h. Indoor Air Quality: Comply with CALGreen requirements for outside air delivery and carbon dioxide monitoring.
 - i. Environmental Comfort: Comply with CALGreen requirements for whole acoustical control and interior sound control.
 - j. Outdoor Air Quality: Comply with CALGreen requirements for reduction of greenhouse gases and ozone depletion.
- 5. Residential Projects Environmental Quality:
 - a. Fireplaces: Comply with requirement that gas fireplaces (if any) shall be direct-vent sealed-combustion type and woodstoves or pellet stoves (if any) comply with U.S. EPA Phase II emissions limits.
 - b. Mechanical Equipment Pollution Control: Cover duct and related air distribution component openings to prevent dust and debris accumulation.
 - c. Finish Material Pollution Control: Comply with CALGreen requirements for volatile organic compound (VOC) emissions including but not necessarily limited to following (as applicable):
 - 1) Adhesives, sealants and caulks.
 - 2) Paints and coatings.
 - 3) Carpet systems including carpet, carpet cushion, and adhesives.
 - 4) Resilient flooring systems.
 - 5) Composite wood products formaldehyde limitations.
 - d. Interior Moisture Control: Comply with CALGreen requirements for vapor retarder at concrete slab foundations and capillary break (aggregate base).
 - e. Building Material Moisture Content: Do not use water damaged building materials, remove and place wet and high moisture content insulation, and do not enclose wall or floor framing when moisture content exceeds 19%.
 - f. Indoor Air Quality: Provide humidistat-controlled bathroom exhaust fans with Energy Star compliance, ducted to terminate outside building.
 - g. Environmental Comfort: Comply with CALGreen requirements for whole house exhaust fan louvers to be insulated or have covers which close when fan is off, and with heating and air-conditioning system design requirements.
- C. Planning and Design: Construction team shall coordinate with Design Team regarding Project Planning and Design methods related to CALGreen requirements related to Project design and shall comply with requirements related to construction.

1.3 QUALITY ASSURANCE

- A. Project Management and Coordination: Contractor to identify one person on Contractor's staff to be responsible for CALGreen issues compliance and coordination.

1. Experience: Environmental project manager to have experience relating to CALGreen building construction.
 2. Responsibilities: Carefully review Contract Documents for CALGreen issues, coordinate work of trades, subcontractors, and suppliers; instruct workers relating to environmental issues; and oversee Project Environmental Goals.
 - a. Submittals: Collect, compile, verify, and maintain sufficient information for submittals indicating compliance with applicable CALGreen requirements.
 3. Meetings: Discuss CALGreen Goals at following meetings.
 - a. Pre-construction meeting.
 - b. Pre-installation meetings.
 - c. Regularly scheduled job-site meetings.
- B. CALGreen Issues Criteria: Comply with requirements listed in CALGreen and various Specification sections.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General Issues: Do not use materials with moisture stains or with signs of mold or mildew.
1. Moisture Stains: Materials that have evidence of moisture damage, including stains, are not acceptable, including both stored and installed materials; immediately remove from site.
 2. Mold and Mildew: Materials that have evidence of growth of molds or of mildew are not acceptable, including both stored and installed materials; immediately remove from site.

2.2 SUBSTITUTIONS

- A. Substitutions Environmental Issues: Requests for substitutions shall comply with requirements specified in Section 01 25 00 – Substitution Procedures, with following additional information required where environmental issues are involved.
1. Indicate each proposed substitution complies with CALGreen requirements.
 2. Owner and Architect reserve right to reject proposed substitutions where CALGreen information is not provided and where substitution may impact mandatory requirements or Project voluntary tier requirements.

PART 3 - EXECUTION

3.1 PROTECTION

- A. Environmental Issues: Protect interior materials from water damage; where interior products not intended for wet applications are exposed to moisture, immediately remove from site.
 - 1. Protect installed products using methods that do not support growth of molds and mildews. Immediately remove from site materials with mold and materials with mildew.

END OF SECTION

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This section describes general quality control requirements.
 - 1. General quality control.
 - 2. Manufacturers' field services.
 - 3. Mock-ups.
 - 4. Independent testing laboratory services and inspections.
- B. Related Requirements:
 - 1. Refer to applicable codes and Specifications sections for test requirements.

1.2 QUALITY CONTROL, GENERAL

- A. Maintain quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

1.3 MANUFACTURER'S FIELD SERVICES

- A. When specified in respective Specification sections, require manufacturer or supplier to have qualified personnel provide on-site observations and recommendations.
 - 1. Observe field conditions, including conditions of surfaces and installation.
 - 2. Observe quality of workmanship.
 - 3. Provide recommendations to assure acceptable installation and workmanship.
 - 4. Where required, start, test, and adjust equipment as applicable.
- B. Representative shall submit written report to Architect or Owner listing observations and recommendations.

1.4 MOCK-UPS

- A. Erect field samples and field mock-ups at locations on site as approved in advance and in accordance with requirements where included in Specifications section.
 - 1. Test mock-ups requiring special equipment may be erected at location having access to necessary equipment; coordinate with Architect.
- B. Field samples and mock-ups not approved and not capable of being acceptably revised shall be removed from site.
- C. Approved field samples and mock-ups may be used as part of Project.

1.5 TESTING LABORATORY SERVICES AND INSPECTIONS

- A. Testing laboratory services and inspections specified and required by applicable codes and regulations will be performed by firms independent of firms related to construction operations and shall be acceptable to applicable authorities.
 - 1. Notify Owner immediately where potential conflict of interest may be involved with testing laboratories or inspection services for Project.
 - 2. Owner or Architect may also require independent testing of items where doubts exist that product or system does not conform to Contract Documents.
 - 3. Owner will employ and pay for testing laboratory and special inspectors to provide Project specific testing and inspections under applicable codes and Specification sections except where indicated otherwise.
 - a. Owner employment of testing laboratory and inspectors shall not relieve Contractor of obligation to perform Work in accordance with requirements of applicable codes and Contract Documents.
 - 1) Laboratory and inspectors may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - b. Retesting required because of non-conformance to specified requirements shall be performed by Owner's testing laboratory.
 - 1) Payment for retesting shall be charged to Contractor by deducting inspection and testing charges from Contract amount.
 - c. Owner provided testing shall be limited to Project specific testing and shall not include general tests or approvals of materials, equipment or systems.
 - d. Owner provided inspections shall be limited to Project design team inspections and special inspectors required by applicable authorities.
- B. Services shall be performed in accordance with requirements of governing authorities and with specified standards.
- C. DSA Projects: Testing and inspections shall be performed in accordance with DSA 103 Form.
- D. Reports will be submitted to Architect in duplicate giving observations and results of tests and inspections, indicating compliance or non-compliance with specified standards and with Contract Documents.
 - 1. Where required, testing laboratory and inspectors will submit copy of tests and inspections directly to enforcing agency.

- E. Contractor shall cooperate with testing laboratory and inspection personnel; furnish tools, samples of materials, design mix, equipment, storage and assistance as requested.
 - 1. Notify Owner, Architect, inspectors, and testing laboratory sufficiently in advance of expected time for operations requiring inspection and testing services.

END OF SECTION

SECTION 01 41 10

SLIP-RESISTANT HARD SURFACES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Teamwork is required to establish requirements for slip-resistance for hard floor and paving surfaces.
 - 1. Authorities Having Jurisdiction: Upon publication of standards and tests by authorities having jurisdiction those standards and tests shall take precedence over this Section.
 - 2. Hard Surface Flooring and Paving: Construction team shall review Contract Documents for hard surface flooring and paving systems and work with Designer and Owner to ensure slip-resistant materials are appropriate to each situation.

1.2 SUBMITTALS

- A. Product Data:
 - 1. Submit manufacturer recommendations for areas and locations where flooring and paving systems are considered to have appropriate slip-resistance and areas where flooring and paving systems are not considered appropriate.
 - 2. Submit information regarding special methods materials used to achieve slip-resistance such as integral abrasives, textures, and coatings.
- B. Test Results: Submit test results for each flooring and paving material indicating slip-resistance testing performed by manufacturer for material and as specified under Testing in this Section.
 - 1. Submit test data for slip-resistance on each flooring and paving system specified indicating which testing system was used and where it was installed.
 - 2. Where certain flooring or paving materials have not been tested previously, submit evidence material has been used successfully in similar applications without well-recorded issues of slip resistance.
 - a. Concrete and flooring and paving materials not by a specific manufacturer and with finishes successfully used for decades shall be considered acceptable unless otherwise directed by authorities having jurisdiction.
 - 1) Acceptable Finishes: Broom finish, medium salted finish.
- C. Maintenance Data: Submit manufacturer recommendations for periodic maintenance recommended to ensure continuance of slip-resistance under anticipated use.
 - 1. Indicate special maintenance procedures which might be required due to special circumstances such as special contaminants due to location of flooring or paving such as food preparation areas, auto repair areas, and other special conditions.

1.3 QUALITY ASSURANCE

- A. Manufacturer: Manufacturers of hard flooring and paving materials, including floor coatings, shall be responsible for laboratory testing of each type of flooring material, including each optional finish, to show suitability for each application indicated.
1. Where tests other than those listed below are used, manufacturer shall provide information indicating comparison of tests results with appropriate tests listed below presented in manner that can be understood by design team
 - a. Acceptable Testing: Following tests may be used where authorities having jurisdiction accept results based on comparisons with other standards.
 - 1) ANSI A326.3 Standard Test Method for Measuring Dynamic Coefficient of Friction of Hard Surface Flooring Materials.
 - a) Limited to interior level hard flooring wet and dry surfaces for tile, stone, terrazzo, and brick.
 - b) Hard floor and paving shall be tested for wet conditions but only those with water and a soap solution comparable to that used in ANSI A326.3, not other contaminants.
 - 2) ASTM E303 Standard Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester (laboratory or field test).
- B. Suppliers and Subcontractor: Review products specified, supplied, and installed to verify they are appropriate based on manufacturer information.

1.4 CLASSIFICATIONS

- A. Due to the complexity of the determination of slip resistance for hard floor and paving surfaces, several classification systems have been established and are presently being referenced by manufacturers.
- B. Wet Pendulum Test Classifications, ASTM E303 British Pendulum Test:

Classification	Slider 96 Rubber (Hard)	Slider 55 Rubber (Soft)
P5 (most slip-resistant)	>54	>44
P4	45-54	40-44
P3	35-44	35-39
P2	25-34	20-34
P1	12-24	<20
P0 (least slip-resistant)	<12	Not Reliable

1. Slider 96 Rubber (Hard): Best for surfaces with relatively low slip resistance (also known as Four S Rubber).

2. Slider 55 Rubber (Soft): Best for surfaces with relatively high slip resistance such as textured concrete, textured tiles, and thermal stone finishes (also known as TRL Rubber).
3. Above numbers in table are considered Mean British Pendulum Numbers (BPN).

1.5 SLIP-RESISTANCE REQUIREMENTS

- A. Where specifications include hard floor and paving surfaces materials shall comply with follow requirements for non-slip surfaces.
 1. Maintenance: Numbers are based on wet hard floors or paving surfaces using materials such as soap solutions where included as part of standard test procedure such as ANSI A326.3 SLS solution (wet).
 - a. All test results are to be based on dynamic coefficient of friction (DCOF).
- B. Slip-Resistant Surface Requirements for Dry Level Interior Locations: Note dry floor friction test is not appropriate for heavily profiled surfaces.
 1. Interior Level Surfaces (Dry): ANSI A326.3/0.20 to 0.42.
 2. Interior Level Surfaces (Dry): AS 4586 Dry Floor Friction Test/D1/≥0.40
- C. Slip-Resistant Surface Requirements based on Water Wet Level Interior Locations: Items 2 and higher are based on ASTM E303 British Pendulum Test hard rubber (12 to 55) and soft rubber (NS to 45) in format shown (R9/12-NS or R10/35 - 35).
 1. General Areas: Locations not anticipated to get wet beyond occasional spills.
 - a. ANSI A326.3: 0.42 or greater.
 - b. ASTM E303 Pendulum Tests: R9/25-20.
 2. Foyer, Transition from Exterior to Interior Space (Wet): R10/35-40.
 3. Mall, Food Court (Wet): R10/35-40.
 4. Shops (Dry): R9/25-20).
 5. Commercial Kitchen serving 100 Plus Meals (Wet): R12/55-50.
 6. Warming Kitchen and Kitchens serving less than 100 Meals (Wet): R11/45-40.
 7. Residential Kitchen (Wet): R10/35-30.
 8. Restaurant Seating Area (Dry): R9/25-20.
 9. Bar Seating Area (Wet): R10/35-30.
 10. Back Bar (Wet): R11/45-40.
 11. Market General Aisles (Dry): R9/25-20.
 12. Market Fresh Food, Meat, and Fish Areas (Wet): R10/35-30.

13. Market Fresh Fruit and Vegetable Area (Wet): R10/35-30.
14. Hospitals and Aged Care Facilities (Dry): R9/25-20.
15. Hospitals and Aged Care Facilities (Wet): R10/35-30.
16. General Public Toilet Facilities without Showers (Wet): R10/35-30.
17. General Public Toilet Facilities with Showers (Wet): R11/45-40.
18. Locker Rooms (Wet): R11/45-40.
19. Interior Stair Tread with Railing (Full tread to minimum 2" at nosing): P2/Hard Rubber 30/Soft Rubber 25.
20. Interior Stair Tread no Railing within 24" (Full tread to minimum 2" at nosing): P3/Hard Rubber 35/Soft Rubber 30.
21. Wet Barefoot Interior Areas (Pools, Showers, Changing Rooms): Limit to materials where manufacturer can provide not less than 5 years successful experience in interior pool, shower, and changing room areas.
 - a. At least 20 projects shall be included in 5-year period with no indication hard floor material involved resulted in recorded slip and fall incidents.

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. This section describes temporary construction facilities and temporary controls.
 - 1. Electricity and lighting.
 - 2. Heat and ventilation.
 - 3. Water and sanitary facilities.
 - 4. Construction aids.
 - 5. Temporary enclosures.
 - 6. Barriers.
 - 7. Cleaning during construction.
 - 8. Project identification.
 - 9. Field offices.
 - 10. Cellular telephone service.
 - 11. Storage.
- B. Related Requirements:
 - 1. Section 01 70 00: Progress cleaning and final cleaning.
 - 2. Section 01 74 10: Waste management.
- C. Provide temporary construction facilities and temporary controls as required to conform to applicable authorities and as required to complete Project in accordance with Contract Documents.
 - 1. Authorities: Contact governing authorities to establish extent of temporary facilities and temporary controls required by authorities.
 - 2. Building Manager: Contact Building Manager to establish extent of temporary facilities and temporary controls required by building management.

1.2 ELECTRICITY AND LIGHTING

- A. Provide electrical service required for construction operations, with branch wiring and distribution boxes located to allow service and lighting by means of construction-type power cords.
 - 1. Connection to existing electrical service is permitted.
 - 2. Owner will pay costs of energy used from existing on-site services.
 - 3. Provide separate metering and reimburse Owner for costs of energy used from existing on-site services.
- B. Provide lighting for construction operations.

1. Permanent lighting may be used during construction; maintain lighting and make routine repairs.

- C. Owner will pay costs of energy used from existing on-site services.
- D. Provide separate metering and reimburse Owner for costs of energy used from existing on-site services.

1.3 HEAT AND VENTILATION

- A. Provide heat and ventilation as required to maintain specified conditions for construction operation, to protect materials and finishes from damage due to temperature and humidity.
- B. Coordinate use of existing facilities with Owner.
 1. Supplement with temporary units as required to maintain specified conditions for construction operations, and to protect materials and finishes from damage due to temperature or humidity.
- C. Owner will pay costs of energy used from existing on-site services.

1.4 WATER AND SANITARY FACILITIES

- A. Provide water service required for construction operations; extend branch piping with outlets located so water is available by use of hoses.
 1. Connection to existing facilities is permitted.
 2. Owner will pay for water used from existing on-site services.
- B. Provide and maintain required sanitary facilities and enclosures.
 1. Existing facilities shall not be used.
 2. Where existing sanitary facilities are designated to be used during construction operations maintain in sanitary condition. Verify availability with Building Management prior to beginning on-site work.

1.5 CONSTRUCTION AIDS

- A. Noise, Dust and Pollution Control: Provide materials and equipment necessary to comply with local requirements for noise, dust and pollution control.
- B. Fire Protection: Maintain on-site fire protection facilities as required by applicable authorities and insurance requirements.
- C. Security: Protect Site and Work; prevent unauthorized entry, vandalism, and theft.
 1. Coordinate with Owner's security program.
- D. Dewatering: Provide and operate drainage and pumping equipment; maintain excavations and site free of standing water.

- E. Use of Existing Facilities: Verify availability of existing facilities for construction operations with Owner prior to beginning on-site construction.

1. Existing stairs shall not be used.
2. Designated existing stairs may be used by construction personnel; coordinate with Owner.
3. Existing elevators shall not be used.
4. Designated elevators may be used, coordinate use with Owner; provide protective coverings for finish surfaces of elevator cars and entrances.

1.6 ENCLOSURES

- A. Temporary Closures: Provide temporary weather-tight closures for exterior openings for acceptable working conditions, for protection for materials, to protect interior materials from dampness, for temporary heating, and to prevent unauthorized entry.

1. Provide doors with self-closing hardware and locks.

- B. Temporary Partitions: Provide temporary partitions as required to separate work areas from occupied areas, to prevent penetration of dust and moisture into occupied areas, and to prevent damage to existing areas and equipment.

1. Construction: Framing and sheet materials with closed joints and sealed edges at intersections with existing surfaces; Flame Spread Rating of 25 in accordance with ASTM E84.
2. Paint surfaces exposed to view in occupied areas.

1.7 BARRIERS

- A. Barriers: Provide barriers as required to prevent public entry to construction areas and to protect adjacent properties from damage from construction operations.

1. Fence: Provide minimum 8-foot high commercial grade chain link or painted solid wood fence around construction site; equip with gates with locks.
2. Covered Walkways: Provide lighted covered painted walkways as required by governing authorities for public rights-of-way and for public access to existing building.

- B. Barricades: Provide barricades as required by governing authorities.

- C. Tree Protection: Provide barriers around trees and plants designated to remain; protect against vehicular traffic, stored materials, dumping, chemically injurious materials, and puddling or continuous running water.

1.8 CLEANING DURING CONSTRUCTION

- A. Control accumulation of waste materials and rubbish; recycle or dispose of off-site.

- B. Clean interior areas prior to start of finish work, maintain areas free of dust and other contaminants during finishing operations.

1.9 PROJECT IDENTIFICATION

- A. Project Sign: Provide minimum 32-square foot Project identification sign of wood frame and exterior grade plywood construction, painted, with computer generated graphics by professional sign maker.
 - 1. Design: As furnished by Architect.
 - 2. Submit to Owner and Architect additional names or changes proposed to Project sign for prior written approval.
 - 3. Erect on site at location established by Architect.
- B. Other Signs: Subject to approval of Architect and Owner.

1.10 FIELD OFFICES

- A. Field Office: Provide weather-tight field office, with lighting, electrical outlets, data outlets, heating, and ventilating equipment, and equipped with furniture.
 - 1. Meeting Space: In addition, provide space for Project meetings with table and chairs to accommodate minimum six persons.
 - 2. Telephone Service: Provide telephone service to field office.
 - 3. Multi-Purpose Copier: Provide plain paper multi-purpose color and black-and-white copier with enlargement and reduction capability and with built-in printer, scanner, and facsimile capabilities.

1.11 CELLULAR TELEPHONE SERVICE

- A. Cellular Telephone Service: Furnish on-site Project Managers with cellular telephone. Ensure Owner and Architect ability to contact site during construction operations.
 - 1. Schedules: Submit schedules of on-site Project Managers with individual cellular telephone numbers to Owner and Architect; maintain schedules and cell phone numbers up to date during Project on-site operations.

1.12 STORAGE

- A. Storage for Tools, Materials, and Equipment: Limit on-site storage to Project area; provide weather-tight storage, with heat and ventilation for products requiring controlled conditions.
 - 1. Maintain adequate space for organized storage and access.
 - 2. Provide lighting for inspection of stored materials.

1.13 REMOVAL

- A. Remove temporary materials, equipment, services, and construction prior to Substantial Completion Inspection.
- B. Clean and repair damage caused by installation or use of temporary facilities.
- C. Restore existing facilities used during construction to specified or original condition.

END OF SECTION

SECTION 01 56 39

TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the protection and trimming and root pruning of trees that interfere with, or are affected by, execution of the Work, whether temporary or new construction.

1.2 SUBMITTAL

- A. The Contractor's representatives and employees shall be experienced in landscape maintenance.
- B. Certification from a qualified arborist 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.
- C. Maintenance recommendation from a qualified arborist for care and protection of trees affected by construction during and after completing the Work. American Welding Society (AWS): D1.1, Structural Welding Code.

1.3 QUALITY ASSURANCE

- A. Arborist Qualifications: An arborist certified by the International Society of Arboriculture or licensed in the jurisdiction where Project is located.
- B. Tree Pruning Standards: Comply with ANSI A300, "Trees, Shrubs, and Other Woody Plant Maintenance--Standard Practices," unless more stringent requirements are indicated.
- C. Pre-installation Conference: Before starting tree protection and trimming, meet with representatives of authorities having jurisdiction, Owner, Landscape Architect, consultants, and other concerned entities. Review tree protection and trimming procedures and responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Drainage Fill: Selected crushed stone, or crushed or uncrushed gravel, washed, ASTM D 448, Size 24, with 90 to 100 percent passing a 2-1/2-inch sieve and not more than 10 percent passing a 3/4-inch sieve.

- B. Topsoil: Fertile, friable, surface soil, containing natural loam and complying with ASTM D 5268. Provide topsoil that is free of stones larger than 1 inch in any dimension and free of other extraneous or toxic matter harmful to plant growth. Obtain topsoil only from well-drained sites where soil occurs in depth of 4 inches or more; do not obtain from bogs or marshes.
- C. Filter Fabric: Manufacturer's standard, non-woven, pervious, geotextile fabric of polypropylene, nylon, or polyester fibers.
- D. Chain Link Fence: Metallic-coated steel chain link fence fabric, 0.120-inch- diameter wire size; 72 inches high, minimum; line posts, 1.9 inches in diameter; terminal and corner posts, 2-3/8 inches in diameter; top rail, 1-5/8 inches in diameter; bottom tension wire, 0.177 inch in diameter; with tie wires, hog ring ties, and other accessories for a complete fence system.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before construction begins, fertilize affected trees to improve tree vigor and health. Soil analysis testing should be completed to assure fertilization with the appropriate fertilizer products.
- B. Temporary Fencing: Install temporary fencing located at or outside the drip line of trees.
- C. Protect tree root systems from damage due to noxious materials caused by runoff or spillage while mixing, placing, or storing construction materials. Protect root systems from flooding, eroding, or excessive wetting caused by dewatering operations.
- D. Do not store construction materials, debris, or excavated material within the drip line of remaining trees. Do not permit vehicles or foot traffic within the drip line; prevent soil compaction over root systems.
- E. Do not allow fires under or adjacent to remaining trees or other plants.

3.2 EXCAVATION

- A. Do not excavate within drip line of trees.
- B. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks and comb soil to expose roots.
 - 1. Cut roots approximately 3 inches back from new construction.
 - 2. 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. Protect roots from damage until they are permanently relocated and covered with soil.

- C. Where utility trenches are required within drip line of trees, tunnel under or around roots by drilling, auger boring, pipe jacking, or digging by hand.
- D. Root Pruning: Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots with sharp pruning instruments; do not break or chop.

3.3 TREE PRUNING

- A. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to written instructions of the qualified arborist.
- B. Root prune existing street trees to prevent sidewalk and curb damage.
- C. Prune remaining trees to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by qualified arborist.
- D. Pruning Standards: Prune trees according to ANSI A300 as follows:
 - 1. Crown cleaning.
 - 2. Crown thinning.
 - 3. Crown reduction.

3.4 TREE REPAIR AND REPLACEMENT

- A. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to written instructions of the qualified arborist.
- B. Remove and replace dead and damaged trees that the qualified arborist determines to be incapable of restoring to a normal growth pattern.
- C. Provide new trees of the same size and species as those being replaced; plant and maintain as specified in Division 2 Section "Planting."

3.5 SOIL AERATION

- A. Aerate surface soil compacted during construction, 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch- diameter holes a minimum of 12 inches deep at 24 inches on center. Backfill holes with an equal mix of augured soil and sand.

3.6 DISPOSAL OF WASTE MATERIALS

- A. Burning is not permitted.
- B. Disposal: Remove excess excavated material, displaced trees, and excess chips from Owner's property.

3.7 TREE PRUNING

- A. Prune tree canopies and branches at the direction of the project arborist to remove any dead or broken branches, and to provide the necessary clearances for the construction equipment.
- B. Root prune existing street trees to prevent sidewalk and curb damage.
- C. Prune remaining trees to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by qualified arborist.
- D. Pruning Standards: Prune trees according to ANSI A300 as follows:
 - 1. Crown cleaning.
 - 2. Crown thinning.
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3.8 TREE REPAIR AND REPLACEMENT

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3.10 DISPOSAL OF WASTE MATERIALS

- A. Burning is not permitted.
- B. Disposal: Remove excess excavated material, displaced trees, and excess chips from Owner's property.

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This section describes basic product requirements governing material and equipment.

1. General product requirements.
2. Product list.
3. Quality assurance.
4. Delivery, storage, and handling.

B. Related Requirements:

1. Section 01 25 00: Substitution procedures.
2. Section 01 30 00: Submittal of manufacturers' certificates.
3. Section 01 77 00: Operation and maintenance data.

1.2 GENERAL PRODUCTS REQUIREMENTS

- A. Products include material, equipment, and systems.
- B. Comply with Specifications, referenced standards, and applicable codes and regulations as minimum requirements.
- C. Provide new materials except as specifically allowed by Contract Documents.
- D. Materials to be supplied in quantity within a Specification section shall be by one manufacturer, shall be the same, and shall be interchangeable.
- E. Provide equipment and systems composed of materials from a single manufacturer except where otherwise recommended by equipment or systems manufacturer or where otherwise indicated in Contract Documents.
- F. Contractor's Options: Comply with following options; requests for substitutions for named manufacturers and products shall comply with requirements specified in Section 01 25 00 – Substitution Procedures.
1. Products Identified by Reference Standards: Select product meeting referenced standard for products specified only by reference standard.
 - a. Requests for Substitutions to be limited to products not complying with referenced standards.
 - 1) Submit justification for non-compliance with reference standards as part of Request for Substitutions; if product is foreign made submit rationale why foreign standards and basic materials indicates compliance.

2. Named Manufacturers: Where names of manufacturers are specified select any named manufacturer product meeting Specifications for products specified by naming one or more manufacturers.
 - a. Submit Request for Substitution for any manufacturer not named.
 3. Named Manufacturers and Named Products: Select any named manufacturer named product meeting Specifications for products specified by naming one or more manufacturers and products.
 - a. Where only one manufacturer and product is named together with additional manufacturers without specific products, Requests for Substitutions to be limited to products not comparable to that specified.
 - 1) Contractors, subcontractors, suppliers, and manufacturers shall take special care to ensure comparable products are being supplied based on design, performance, quality, and longevity.
 - 2) Substitutions: Submit Request for Substitution for any manufacturer not named and for products not comparable to those specified in design, performance, quality, and longevity.
 4. Basis of Design: Where manufacturer or manufacturer and product both are indicated as Basis of Design, submit Request for Substitution for other manufacturers and products.
 5. "Or Equal" Clauses: Submit request for substitution for manufacturer or product not specifically named in Specifications where terms "or equal", "or approved equal", or similar references are made.
- G. Nameplates: Do not attach or imprint manufacturer or producer nameplates on exposed surfaces in occupied spaces except for required labels and operating data.
1. Equipment Nameplates: Provide permanent nameplate on service connected and power operated equipment located on easily accessible surface inconspicuous in occupied spaces.
 - a. Provide name of product and manufacturer, model and serial number, capacity, speed, rating, and similar information.

1.3 SUBMITTALS

- A. Product List: Within 35 days after award of Contract, submit to Owner and Architect a complete list of major products proposed for installation, with name of manufacturer, trade name, and model.
- B. Product List: Prior to submittal of second Request for Payment, submit to Architect complete list of major products which are proposed for installation, with name of manufacturer, trade name, and model.
 1. Tabulate products by Specification number and title.

- C. Substitutions: Refer to Section 01 25 00 – Substitution Procedures.

1.4 QUALITY ASSURANCE

- A. Comply with industry standards and applicable codes except when more restrictive tolerances or requirements indicate more rigid standards or precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality.
- C. Install products straight, true-to-line, and in correct relationship to adjacent materials, with hairline joints, free of rough, sharp and potentially hazardous edges.
- D. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.
 - 1. Seismic Anchors: Conform to code requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Transport products by methods to avoid product damage, deliver in undamaged condition in manufacturer's unopened containers or packaging.
- B. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible.
- C. Store sensitive products in weather-tight enclosures; maintain within temperature and humidity ranges required by manufacturer's instructions.
- D. For exterior storage of fabricated products, place on sloped supports above ground.
- E. Store loose granular materials on solid surfaces in a well-drained area; prevent mixing with foreign matter.
- F. Arrange storage to provide access for inspection; periodically inspect to assure products are undamaged and are maintained under required conditions.
- G. Provide equipment and personnel to handle products by methods to prevent soiling and prevent damage.
- H. Promptly inspect shipments to assure products comply with requirements, quantities are correct, and products are undamaged.
- I. Immediately remove from Project products damaged, wet, stained, and products with mold and products with mildew.
 - 1. Take special care to prevent absorbent products such as gypsum board and acoustical ceiling units from becoming wet.

END OF SECTION

SECTION 01 70 00

EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This section describes execution requirements.
 - 1. Installer qualifications.
 - 2. Examination.
 - 3. Manufacturer's instructions.
 - 4. Installation.
 - 5. Cleaning.
 - 6. Protection.
- B. Related Requirements:
 - 1. Section 01 50 00: Cleaning during construction.
 - 2. Section 01 77 00: Closeout procedures.
 - 3. Section 01 79 00: Demonstration and training.

1.2 INSTALLER QUALIFICATIONS

- A. Experienced Installers: Installers to have minimum five-years successful experience installing items like those required for Project, except for individuals in training under direct supervision of experienced installer.

1.3 EXAMINATION

- A. Acceptance of Conditions: Beginning installation of a product signifies installer has examined substrates, areas, and conditions for compliance with manufacturer requirements for tolerances and other conditions affecting performance.
- B. Field Measurements: Take field measurements as required to fit Work properly; recheck measurements prior to installing each product.
 - 1. Where portions of Work are to fit to other construction verify dimensions of other construction by field measurements before fabrication; allow for cutting and patching to avoid delaying Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

1.4 MANUFACTURERS' INSTRUCTIONS

- A. Manufacturer's Recommendations: When work is specified to comply with manufacturers' recommendations or instructions, distribute copies to persons involved and maintain one set in field office.
 - 1. Conform to requirements specified in Section 01 30 00 for submittal of recommendations or instructions to Architect; submit to Architect only where specified or where specifically requested; otherwise keep in Field Office.
- B. Perform work in accordance with details of recommendations and instructions and specified requirements.
 - 1. Should a conflict exist between Specifications and recommendations or instructions consult with Architect.
- C. Where manufacturer's information notes special recommendations in addition to installation instructions, comply with both recommendations and instructions.

1.5 INSTALLATION

- A. Pre-Installation Meetings: Installers and suppliers are to attend pre-installation meetings scheduled by Contractor.
- B. Comply with manufacturers written recommendations and installation instructions unless more restrictive requirements are specified.
- C. Locate Work and components accurately, in correct alignment and elevation.
 - 1. Make vertical work plumb and horizontal work level.
 - 2. Install components to allow space for maintenance and ease of removal for replacement.
- D. Install products at time and under conditions to ensure best possible results; maintain conditions required for product performance until Substantial Completion.
- E. Conduct operations so no part of Work is subject to damaging operations or excessive loads during normal conditions.
- F. Securely anchor permanent construction in place, accurately located and aligned with other portions of Work.
- G. Allow for building movement including thermal expansion and contraction.
- H. Make joints of uniform width; arrange joints as indicated, for best visual effect where not otherwise indicated; fit exposed connections together to form hairline joints except where otherwise indicated.

1.6 CLEANING

- A. Cleaning During Construction: Specified in Section 01 50 00 - Temporary Facilities and Controls.

- B. Progress Cleaning: Keep installed areas clean using cleaning materials specifically recommended by manufacturers of product being cleaned; where not otherwise recommended use nontoxic materials that will not damage surfaces.
 - 1. Remove debris from concealed spaces before enclosing space.
 - 2. Supervise construction operations to assure no part of construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during construction period.
- C. Final Cleaning: Execute final cleaning at Substantial Completion.
 - 1. Clean interior and exterior surfaces exposed to view; remove temporary labels, stains and foreign substances; polish transparent and glossy surfaces; vacuum carpeted and soft surfaces.
 - a. Vacuuming Equipment: Type with high efficiency particulate arrestor (HEPA) type filters; properly maintained.
 - 2. Clean equipment and fixtures to a sanitary condition, clean filters of mechanical equipment, replace filters where cleaning is impractical.
 - a. Clean ducts.
 - 3. Clean site; sweep paved areas.
 - 4. Remove waste, surplus materials and rubbish from Project and site; recycle to maximum extent feasible.

1.7 PROTECTION

- A. Protect products subject to deterioration with impervious cover. Provide ventilation to avoid condensation and trapping water.
- B. Take care to use protective covering and blocking materials that do not soil, stain, or damage materials being protected.
- C. After installation, provide coverings to protect products from damage from traffic and construction operations, remove when no longer needed.
- D. Protect interior materials from water damage; immediately remove wet materials from site to prevent growth of mold and mildew on site.

END OF SECTION

SECTION 01 73 00

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

- A. Contractor is responsible for cutting, fitting and patching to complete Work and to:
1. Make its parts fit together properly.
 2. Uncover work to provide for installation of ill-timed work.
 3. Remove and replace defective work.
 4. Remove and replace work not conforming to Contract Documents.
 5. Remove samples of installed work as required for testing.
 6. Provide routine penetrations of non-structural surfaces for installation of piping.
 7. Provide routine penetrations of non-structural surfaces for installation of conduit.
- B. Related Requirements:
1. Section 01 50 00: Temporary facilities and controls.
 2. Section 02 41 00: Structure demolition.
 3. Section 02 41 20: Selective building demolition for remodeling.

1.2 SUBMITTALS

- A. Submit written request well in advance of cutting or alteration which affects:
1. Work of Owner or separate contractor.
 2. Structural value or integrity of any element of Project.
 3. Integrity of weather-exposed or moisture-resistant elements.
 4. Efficiency, operational life, maintenance or safety of operational elements.
 5. Visual qualities of sight-exposed elements.
- B. Request shall include:
1. Identification of Project and description of affected work.
 2. Necessity for cutting or alteration.
 3. Effect on work of Owner or separate contractor.
 4. Effect on structural integrity, or weatherproof integrity of Project.
 5. Alternatives to cutting and patching.
 6. Cost proposal, when applicable.
 7. Written permission of separate contractor whose work will be affected.
 8. Description of proposed work including:
 - a. Scope of cutting, patching, alteration, or excavation.
 - b. Products proposed to be used.
 - c. Extent of refinishing to be included.
- C. Should conditions of Work or schedule indicate a change of products from original installation, Contractor shall submit request for substitution as specified in Section 01 25 00 – Substitution Procedures.
- D. Submit written notice to Architect designating date and time work will be uncovered.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Comply with Specifications and standards for each specific product involved.
- B. Where Specifications and standards have not been provided, provide materials and fabrication consistent with quality of Project and intended for commercial construction.
- C. Provide new materials for cutting and patching unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect existing conditions of Project, including elements subject to damage or to movement during cutting and patching.
- B. After uncovering work, inspect conditions affecting installation of products, or performance of work.
- C. Report unsatisfactory or questionable conditions to Architect in writing; do not proceed with work until Architect has provided further instructions.

3.2 PREPARATION

- A. Provide adequate temporary support as necessary to assure structural value or integrity of affected portion of Work.
 - 1. Provide services of licensed engineer for designing temporary support where required by applicable authorities for temporary supports and for shoring; submit engineering calculations directly to applicable authorities upon request.
- B. Protect other portions of Project from damage.

3.3 PERFORMANCE

- A. Execute cutting by methods that provide proper surfaces to receive installation of repairs and finishes.
 - 1. Execute excavating and backfilling by methods which will prevent settlement, and which will prevent damage to other work.
- B. Employ same installer or fabricator to perform cutting and patching work as employed for new construction for:
 - 1. Weather-exposed or moisture resistant elements.
 - 2. Sight-exposed finished surfaces.
- C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

- D. Restore work that has been cut or removed; install new products to provide completed Work in accordance with requirements of Contract Documents.
- E. Fit work tight to pipes, sleeves, ducts, conduit and penetrations through surfaces.
- F. Refinish entire surfaces as necessary to provide even finish to match adjacent finishes:
 - 1. For continuous surfaces, refinish to nearest intersection.
 - 2. For an assembly, refinish entire unit.

END OF SECTION

SECTION 01 74 10

WASTE MANAGEMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Project requires special Waste Management Program.
 - 1. LEED Waste Management Goals: As required for level listed in Section 01 35 10.
 - 2. CALGreen Waste Management: As required in Section 01 35 15.
 - 3. Provide itemization of costs related to Waste Management Program.
 - 4. Effect optimum control of solid wastes.
 - 5. Prevent environmental pollution and damage.
- B. Related Work:
 - 1. Section 01 35 10: LEED certification requirements.
 - 2. Section 01 35 15: CALGreen environmental requirements.
 - 3. Section 01 50 00: Temporary facilities and controls.

1.2 DEFINITIONS

- A. Inert Fill: A permitted facility that accepts inert waste such as asphalt and concrete exclusively.
- B. Class III Landfill: A landfill that accepts non-hazardous waste such as household, commercial, and industrial waste, including construction, remodeling, repair, and demolition operations.
- C. Construction and Demolition Waste: Includes solid wastes, such as building materials, packaging, rubbish, debris, and rubble resulting from construction, remodeling, repair, and demolition operations.
 - 1. Rubbish: Includes both combustible and noncombustible wastes, such as paper, boxes, glass, crockery, metal and lumber scrap, tin cans, and bones.
 - 2. Debris: Includes both combustible and noncombustible wastes, such as leaves and tree trimmings that result from construction or maintenance and repair work.
- D. Chemical Waste: Includes petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals and inorganic wastes.
- E. Sanitary Wastes:
 - 1. Garbage: Refuse and scraps resulting from preparation, cooking, distribution, or consumption of food.
 - 2. Sewage: Domestic sanitary sewage.

1.3 SUBMITTALS

- A. Waste Management Program: Comply with Contract Documents and applicable code requirements for salvaging, recycling, and disposing of nonhazardous waste.
 - 1. Prior to commencement of Work, schedule and conduct meeting with Owner and Architect to discuss proposed Waste Management Program.
 - 2. Develop mutual understanding relative to details of recycling, and rebate programs.
 - 3. Prepare and submit a written and graphic Waste Management Program including, but not limited to, the following:
 - a. Indicate procedures to be implemented.
 - b. Estimate total Project waste to be generated, and estimated cost of disposing of Project waste in landfills.
 - c. Estimate total cubic yards of following waste categories to be diverted from landfill.
 - 1) Clean dimensional wood, palette wood.
 - 2) Plywood, oriented strand board, and medium density fiberboard.
 - 3) Cardboard, paper, packaging.
 - 4) Other items as directed by Owner and Architect.
 - d. Estimate amounts of following waste categories in appropriate units (weight, feet, square yards, gallons).
 - 1) Metals.
 - 2) Gypsum board.
 - 3) Carpet.
 - 4) Paint.
 - 5) Other items as directed by Owner and Architect.
 - e. Submit permit or license and location of waste disposal areas.
 - f. Submit procedures for recycling/re-use program.
 - g. Submit procedures for rebate programs.
 - h. Revise and resubmit Waste Management Program as required by Owner and Architect.
 - 1) Review of Contractor's Waste Management Program will not relieve Contractor of responsibility for control of pollutants and other environmental protection measures.

- B. Submit summary of solid waste generated by Project with each application for progress payment, on form acceptable to Owner and Architect; include manifests, weight tickets, receipts, and invoices identifying Project and waste delivered to following locations.
 - 1. Recycling Centers.
 - 2. Class III landfills.
 - 3. Inert fills.
- C. Prepare rebate information and product documentation as required for Owner to qualify for rebate programs; submit with final closeout submittals.
 - 1. Where feasible submit in electronic format, otherwise in 3-ring binder.

1.4 RECYCLING PROGRAM

- A. Recycling: Implement recycling program that includes separate collection of waste materials of following types as applicable to Project requirements; recycling program to be applied by Contractors and subcontractors.
 - 1. Land clearing debris.
 - 2. Asphaltic concrete.
 - 3. Concrete.
 - 4. Masonry materials.
 - 5. Ferrous metal.
 - 6. Non-ferrous metal.
 - 7. Clean dimensional wood and palette wood.
 - 8. Plywood, oriented strand board, and medium density fiberboard.
 - 9. Paper - bond.
 - 10. Paper - newsprint.
 - 11. Cardboard and paper packaging materials.
 - 12. Glass.
 - 13. Plastics.
 - 14. Gypsum board (unpainted).
 - 15. Paint.
 - 16. Rigid foam.
 - 17. Carpet and pad.
 - 18. Beverage containers.
 - 19. Porcelain plumbing fixtures.
 - 20. Insulation.
 - 21. Others as appropriate.
- B. Handling: Keep materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to recycling process.
 - 1. Clean materials contaminated prior to placing in collection containers.
 - 2. Arrange for collection by or delivery to appropriate recycling center or transfer station that accepts construction and demolition waste for purpose of recycling.
- C. Participate in Re-Use Programs: Rebates, tax credits, and other savings obtained for recycled or re-used materials shall accrue to Contractor.

END OF SECTION

SECTION 01 77 00

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This section describes Contract closeout procedures.
 - 1. Substantial Completion.
 - 2. Final Completion.
 - 3. Project record documents.
 - 4. Material and finish data.
 - 5. Operation and maintenance manuals.
- B. Related Requirements:
 - 1. Section 01 30 00: Administrative requirements including attic stock.
 - 2. Section 01 78 00: Warranties.
 - 3. Section 01 79 00: Demonstration and training.

1.2 SUBSTANTIAL COMPLETION

- A. Immediately prior to Substantial Completion, schedule agency reviews as required for "temporary certificate of occupancy" or for "certificate of occupancy".
- B. When Contractor considers Work, or a designated portion thereof is substantially complete, submit written notice, with list of items to be completed or corrected.
 - 1. List ("Punch List"): Format pre-approved by Owner and Architect; tabular form with each space listed required.
- C. Within a reasonable time, Owner and Architect will inspect status of completion and may add to "Punch List".
 - 1. Contractor shall pay for Architect's time and direct expenses where more than one Substantial Completion inspection is required.
- D. Should Owner and Architect determine Work is not substantially complete, Contractor will be promptly notified in writing, giving reasons.
- E. Contractor shall remedy deficiencies and send a second written notice of substantial completion; Architect will reinspect Work.
 - 1. Contractor shall pay for Architect's time and direct expenses where more than one Substantial Completion inspection is required.
- F. When Work is determined to be substantially complete by Architect, a Certificate of Substantial Completion will be prepared in accordance with General Conditions.

- G. DSA Projects: Contractor shall complete DSA 6-C Form and upload electronically to DSABox within three days of completion of Work.

1.3 FINAL COMPLETION

- A. When Work is complete, submit written certification indicating:
 - 1. Work has been inspected for compliance with Contract Documents.
 - 2. Work has been completed in accordance with Contract Documents and deficiencies listed (in 'Punch List') with Certificate of Substantial Completion have been corrected.
 - 3. Equipment and systems have been tested in presence of Owner's representative and are operational.
 - 4. Work is complete and ready for final inspection.
- B. Special Submittals: In addition to submittals required by Contract, submit following.
 - 1. Provide submittals required by governing authorities to governing authorities with copies included in Project Record Documents.
 - 2. Submit final statement of accounting giving total adjusted Contract Sum, previous payments, and sum remaining due.

1.4 PROJECT RECORD DOCUMENTS

- A. Keep documents current; do not permanently conceal any work until required information has been recorded.
 - 1. Owner will provide Contractor with a separate set of Drawings to maintain for Project Record Documents.
 - 2. Store reproducible Drawings, one set of Project Manual, and one copy of each Change Order separate from documents used for construction, for use as Project Record Documents.
 - 3. Indicate actual work on Drawings; indicate actual products used in Project Manual, including manufacturer, model number and options.
 - 4. Update Project Record Documents daily and allow for Architect inspection at least once a month.
- B. At Contract close-out submit documents with transmittal letter containing date, Project title, Contractor's name and address, list of documents, and signature of Contractor.
- C. As-Built Documents: General Contractor shall have electronic "As Built" sets of Contract Documents (Project Drawings and Project Specifications) prepared prior to Final Completion.
 - 1. Contractor shall use one complete electronic set of Contract Documents (Drawings and Specifications) for use for "As-Built".

2. As-Built Drawings: Revise Drawings based on Record Documents and field measurements made after installation and indicate actual locations of structural elements, ducts, piping, wiring, and equipment.
 - a. Professional draftspersons experienced in electronic media used for Contract Documents shall revise original Project Drawings based on information recorded on Project Record Documents.
3. As-Built Specifications: Revise Specifications to indicate manufacturers who provided materials specified along with specifics indicating accessories, options, and finishes used in Project.
 - a. Cross referencing Submittal records is acceptable for accessories only.
4. Review Submittal: Submit two copies of electronic media of "As-Built" Documents to Architect for review.
 - a. After Architect review, revise where indicated and submit final electronic media to Owner.
- D. Final Completion Submittal: At Project Completion submit both Project Record Documents and As-Built Documents with transmittal letter containing date, Project title, Contractor's name and address, list of documents, and signature of Contractor.

1.5 MATERIAL AND FINISH DATA

- A. Provide data for primary materials and finishes.
- B. Submit two sets prior to final inspection, bound in 8-1/2" by 11" three-ring binders with durable plastic covers, clearly identified regarding extent of contents.
 1. Electronic Format: Where available in electronic format, submit USB 3.0 flash drives with information required for material and finish data.
- C. Arrange by Specification division and give names, addresses, and telephone numbers of subcontractors and suppliers. List:
 1. Trade names, model or type numbers.
 2. Cleaning instructions.
 3. Product data.
 4. Maintenance recommendations.

1.6 OPERATION AND MAINTENANCE MANUALS

- A. Provide manuals for:
 1. Electrically operated items.
 2. Electrical equipment and controls.
 3. Maintenance manuals provided as part of Submittals.
- B. Submit two sets prior to final inspection, bound in 8-1/2" by 11" three-ring binders with durable plastic covers, clearly identified regarding extent of contents.

- C. Provide a separate volume for each system, with a table of contents and index tabs for each volume.
- D. Arrange by Specification division and gives names, addresses, and telephone numbers of Subcontractors and suppliers. List:
 - 1. Appropriate design criteria.
 - 2. List of equipment and parts lists.
 - 3. Operating and maintenance instructions.
 - 4. Shop drawings and product data.
- E. Electronic Format: Where available in electronic format, submit two USB 3.0 flash drives with information required for operation and maintenance manuals.

END OF SECTION

SECTION 01 78 00

WARRANTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Warranties: Compile required, and incidental warranties required by Contract Documents.
 - 1. Manufacturer Warranties: Provide manufacturer's standard warranties where specified including inspections and services included or required as part of manufacturer's standard warranty.
 - 2. Special Warranties: Provide special warranties as required by Specifications sections.
 - 3. These warranties shall be in addition to and not a limitation of other rights Owner may have against Contractor under Contract Documents and which may be prescribed by law, regardless of wording of warranty.
- B. Extended Correction Period: Contractor shall correct failure of materials and systems to perform in a manner consistent with their intended use including but not limited to failure of waterproofing and roofing systems to resist penetration from water.
 - 1. Standard Correction Period: One year after Substantial Completion or Beneficial Occupancy by Owner except where otherwise noted in Contract Documents; coordinate with General Conditions and Supplementary Conditions.
 - a. Items used by Contractor during construction operations shall not be considered substantially completed.
 - b. Correction of Work Period begins with Owner occupancy not completion of component.
 - 2. Extended Correction Period: Requirements are same as standard correction period but for an extended period as indicated in Specifications sections.
 - 3. Contractor Responsibilities: Bear cost of correcting failed work and replacing construction damaged by failure of materials and systems to perform in a manner consistent with their intended use during correction period.
 - a. Requirements for correction period shall apply to Subcontractors, suppliers, installers, and those responsible for failed work.
 - b. Owner and Design Team shall not be responsible for determining degree of responsibility of those involved.
 - 4. Owner's Rights under Law: Correction period shall be in addition to and not a limitation of other rights Owner may have against Contractor under Contract Documents and which may be prescribed by law.

1.2 FORM OF SUBMITTAL

- A. Special Warranty and Extended Correction Period Forms: Provide duplicate copies, notarized or on Contractor and Manufacturer's letterhead without conditions or exceptions to requirements specified.
 - 1. Assemble documents executed by subcontractors, installers, suppliers, and manufacturers.
 - 2. Provide table of contents and assemble in binder with durable plastic cover, clearly identified regarding extent of contents.
 - 3. Electronic Format: Submit USB 3.0 flash drives of warranties, in Microsoft Word.
- B. Manufacturer Warranty Forms: Use manufacturer's standard forms unless otherwise directed in Contract Documents; completed form shall not detract from or confuse interpretations of Contract Documents.
 - 1. Manufacturer's authorized representative shall sign manufacturer warranties.
 - 2. Subcontractor and installer shall countersign warranty where specified.
 - a. Provide required warranties for waterproofing and roofing systems countersigned by subcontractor and installer.
- C. Submit final warranties prior to final application for payment.
 - 1. For equipment put into use with Owner's permission during construction, submit within ten days after first operation.
 - 2. For items of Work delayed materially beyond Date of Substantial Completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.
- D. Provide information for Owner's personnel regarding proper procedure in case of failure and instances that might affect validity of manufacturer warranty.
- E. Size: 8-1/2" by 11" for three-ring binder; fold larger sheets to fit.

1.3 WARRANTIES AND CORRECTION OF WORK DOCUMENTS

- A. Warranties and Correction of Work Documents are intended to protect Owner against failure of work and against deficient, defective and faulty materials and workmanship, regardless of sources.
- B. Limitations: Warranties and correction of work requirements are not intended to cover failures that result from:
 - 1. Unusual or abnormal phenomena of the elements.
 - 2. Owner's misuse, maltreatment or improper maintenance of work.
 - 3. Vandalism after substantial completion.

- 4. Insurrection or acts of aggression including war.
- C. Related Damages and Losses: Remove and replace work which is damaged as result of failure, or which must be removed and replaced to provide access for correction of work.
- D. Reinstatement: After correction of work reinstate warranty or extended correction period for corrected work to date of original expiration, but not less than half original period.
 - 1. Correction of Work Period: The general correction of work period specified shall not be extended by corrective work except to extent required to correct failure and repair or replace materials damaged by failure.
- E. Replacement Cost: Replace or restore failing items without regard to anticipated useful service lives where part of correction of work period, extended correction of work period, and special warranty period unless otherwise noted.
- F. Rejection of Warranties: Owner reserves right to reject unsolicited and coincidental product warranties that detract from or confuse interpretations of Contract Documents.

END OF SECTION

SECTION 01 79 00

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide equipment and systems demonstration and instruction in accordance with Contract Documents.
 - 1. Video record seminars and system demonstrations.
- B. Related Sections:
 - 1. Section 01 31 00: Project management and coordination.
 - 2. Section 01 77 00: Contract closeout procedures.
 - 3. Refer to Facility Services Subgroups for mechanical and electrical requirements.

1.2 DESCRIPTION

- A. Seminar Agenda and Outline:
 - 1. Prepare a seminar agenda and outline in consultation and cooperation with Owner. Include following:
 - a. Equipment and systems that will be included in seminars.
 - b. Name of companies and representatives presenting at seminars.
 - c. Outline of each seminar's content.
 - d. Time and date allocated to each system and item of equipment.
 - 2. Submit preliminary seminar agenda and outline for review and comment by Owner.
 - a. Revise and resubmit agenda and outline until all seminar requirements have been satisfied and seminar dates and presenters have been finalized.
 - 3. Submit final seminar agenda and outline no later than eight weeks before date of Acceptance of Work.
- B. Seminar Organization:
 - 1. Contractor's presentation leaders shall chair seminars.
 - a. Coordinate qualification of training personnel, seminar contents, and presentations with Owner.
 - 2. Coordinate individual presentations and ensure manufacturer's representatives scheduled to be at training seminars are present.

3. Arrange for presentation leaders familiar with design operation, maintenance and troubleshooting of equipment and systems.
 - a. Where one person is not familiar with all aspects of equipment or system; arrange for specialists familiar with each aspect.
4. Coordinate proposed seminar dates with Owner and select mutually agreeable dates.
5. Video Recording: Arrange for video recording (audio and video) of training seminars and system demonstrations, including seminar and demonstration questions and answers.

C. Seminar Content:

1. Architect's Consultants will explain design philosophy of primary systems.
2. Include following information in presentations dealing with specific systems.
 - a. An overview of how system is intended to operate.
 - b. Describe design parameters, constraints and operational requirements.
 - c. Describe system operation strategies.
 - d. Provide information to help in identifying and troubleshooting problems.
3. Include following information in presentations dealing with equipment.
 - a. Explanation of how equipment operates.
 - b. Recommended preventative and routine maintenance.

D. System Demonstration:

1. Demonstrate operation of equipment and systems when specified in individual technical sections. Include following in demonstration.
 - a. Start-up and shut down.
 - c. Operation.
 - d. Scheduled and preventative maintenance.
 - e. Troubleshooting.
2. Demonstration may be conducted at time of original starting with Owner's prior approval.

E. Seminar and Demonstration Questions:

1. Be prepared to answer questions raised by Owner's personnel at demonstrations and seminars.
2. If unable to satisfactorily answer questions immediately, provide written response within three days.

F. Use manufacturer's operation and maintenance data as basis of instruction.

1.3 SUBMITTALS

- A. Video Recording: Submit three copies of each video recording in DVD format acceptable to Owner; include label on each DVD and on each container identifying Project and Seminar content.

END OF SECTION

SECTION 02 40 00

DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. "Geotechnical Investigation Venetia Valley K-8 School", prepared by Miller Pacific Engineering Group, dated April 27, 2017.

1.2 SUMMARY

- A. Removing above-grade site improvements within limits indicated.
- B. Disconnecting, capping or sealing, and abandoning site utilities in place.
- C. Disconnecting, capping or sealing, and removing site utilities.
- D. Disposing, recycling, reusing, and/or salvaging of objectionable material.

1.3 RELATED SECTIONS

- A. Section 31 10 00 – Site Clearing.
- B. Section 31 20 00 – Earth Moving.

1.4 DEFINITIONS

- A. ANSI: American National Standards Institute.
- B. CAL-OSHA: California Occupational Safety and Health Administration.
- C. CA-CHPS: California Collaborative for High Performance Schools

1.5 SUBMITTALS

- A. Follow Submittal procedure outlined in Section 01 33 00 – Submittal Procedures.

1.6 PROJECT CONDITIONS

- A. Except for materials indicated to be stockpiled or to remain the Owner's property, cleared materials are the Contractor's property. Remove cleared materials from site and dispose, recycle, reuse, and/or salvage the materials in a lawful manner. If possible, identify an organization within 1000 miles that will purchase or accept the donation of construction waste for reuse. This organization must intend to

reuse the waste as-is, or sell the material for the intent of re-use (CA-CHPS Criteria).

- B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store where indicated on plans or where designated by the Owner. Avoid damaging materials designated for salvage.
- C. Unidentified Materials: If unidentified materials are discovered, including hazardous materials that will require additional removal other than is required by the Contract Documents, immediately report the discovery to the Owner. If necessary, the Owner will arrange for any testing or analysis of the discovered materials and will provide instructions regarding the removal and disposal of the unidentified materials.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

- A. Backfill excavations resulting from demolition operations with on-site or import materials conforming to structural backfill defined in Section 31 20 00 Earth Moving.

PART 3 EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points during construction.
- B. Protect existing site improvements to remain during construction.

3.2 RESTORATION

- A. Restore damaged improvements to their original condition, as acceptable to the Owner.

3.3 UTILITIES

- A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed or abandoned.
- B. Arrange to shut off indicated utilities with utility companies or verify that utilities have been shut off.
- C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless authorized in writing by the Owner, and then only after arranging to provide temporary utility services according to requirements indicated.
- D. Coordinate utility interruptions with utility company affected.
- E. Do not proceed with utility interruptions without the permission of the Owner and utility company affected. Notify Owner and utility company affected two working days prior to utility interruptions.

- F. Excavate and remove underground utilities that are indicated to be removed.
- G. Securely close ends of abandoned piping with tight fitting plug or wall of concrete minimum 6-inches thick.

3.4 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, and gutters, as indicated. Where concrete slabs, curb, gutter and asphalt pavements are designated to be removed, remove bases and subbase to surface of underlying, undisturbed soil.
- C. Unless the existing full-depth joints coincide with line of pavement demolition, neatly saw-cut to full depth the length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
- D. Remove driveways, curbs, gutters and sidewalks by saw cutting to full depth. If saw cut falls within 30-inches of a construction joint, expansions joint, score mark or edge, remove material to joint, mark or edge.

3.5 BACKFILL

- A. Place and compact material in excavations and depressions remaining after site clearing in conformance with Section 31 20 00 Earth Moving.

3.6 DISPOSING

- A. Remove surplus obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off the Owner's property. In addition to disposing the materials, consider recycling or donating/selling the materials to a reuse organization within 1000 miles.

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SECTION 02 41 20

SELECTIVE BUILDING DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Selectively remove materials, systems, components, fixtures, casework and equipment as designated and as required for completion of Project as indicated.
 - 1. Cap and identify active utilities.
- B. Related Sections:
 - 1. Section 01 50 00: Temporary facilities including barriers and waste management.
 - 2. Section 01 73 00: Cutting and patching.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Do not interfere with use of adjacent building spaces not in Project; maintain free and safe passage to and from.
 - 2. Prevent movement of structural components, provide and place bracing and be responsible for safety and support of structural components. Assume liability for movement, settlement, damage or injury.
 - 3. Cease operations and notify Architect immediately if safety of structural components appears to be endangered; take precautions to properly support structures. Do not resume operations until safety is restored.
 - 4. Prevent dust from selective demolition from contaminating adjacent occupied building areas; clean construction dust from adjacent occupied area immediately upon direction of Building Manager.
- B. Design/Build: Provide special engineering to ensure compliance with applicable codes and Contract Documents for support systems.
- C. Scheduling: Do not close or obstruct roadways without permits. Conduct operations with minimum interference to adjacent traffic.

1.3 SUBMITTALS

- A. Action Submittals: Submit selective demolition operational sequence to ensure Project sequencing is consistent with Owner needs.
- B. Informational Submittals: Submit permits for transport and disposal of debris.

1.4 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control and for construction waste.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Debris: Maintain possession of materials being demolished except where noted as a material for reinstallation or a material to be retained by Owner. Immediately remove debris from site.
 - 1. Immediately remove from site wet materials and materials with water stains, with mold, and with mildew.
- B. Materials for Reinstallation: Carefully remove, store and protect materials indicated to be reinstalled. Contact Owner and Architect prior to beginning demolition to determine extent of other materials that might be suitable for reinstallation.
 - 1. Inventory and record condition of items to be reinstalled.
- C. Owner Retained Materials: Contact Owner prior to beginning demolition to determine extent of materials to be retained. Carefully remove materials indicated to be retained by Owner; deliver and store where directed.
 - 1. Inventory and record condition of items to be retained by Owner.

PART 3 - EXECUTION

3.1 EXISTING SERVICES

- A. Disconnect or remove utility services as required for completion of Project; disconnect, stub off, and cap utility service lines not required for new construction.
 - 1. Do not remove utilities discovered during demolition but not indicated without first determining purpose for utility; coordinate with Architect and Engineers.
- B. Do not disrupt services to adjacent building areas not in Project.
- C. Place markers to indicate location of disconnected services; identify service lines and capping locations on Project Record Documents.

3.2 DEMOLITION

- A. Demolish indicated appurtenances as indicated and as required for Project completion in an orderly and careful manner.
 - 1. Use methods that do not damage materials indicated to remain.
 - 2. Cut concrete and masonry using masonry saws and hand tools; provide sharp clean cuts requiring minimal patching for new construction.

3. Use impact tools only where specifically approved in advance for areas where operations do not disturb building occupancy.
- B. Perform demolition in accordance with authorities having jurisdiction.
- C. Remove demolished materials from site, unless otherwise directed.
 1. Remove from site, contaminated, vermin infested, and dangerous materials encountered and dispose of by safe means so as not to endanger health of workers or public.
- D. Remove tools and equipment upon completion of work; leave area in condition acceptable to Owner and Architect.

3.3 REPAIR

- A. Repair damage to adjacent construction caused as result of this work.
- B. Repair demolition beyond that required.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide stock and custom fabricated metal items scheduled at end of this Section, complete in respect to function as intended.
 - 1. Metal fabrications includes items made from iron and steel shapes, plates, bars, strips, tubes, pipes and castings which are not a part of structural steel or metal systems specified elsewhere.

1.2 REFERENCES

- A. American Welding Society (AWS): D1.1, Structural Welding Code.
- B. National Association of Architectural Metal Manufacturers (NAAMM): Pipe Rail Manual.
- C. National Association of Architectural Metal Manufacturers (NAAMM):
 - 1. Pipe Rail Manual.
 - 2. Heavy Duty Metal Bar Grating Manual.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Railing Design/Build: Provide special engineering for railings to ensure railings comply with applicable codes and Contract Documents.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's literature for products used in metal fabrications, including paint, grout and manufactured items.
- B. Shop Drawings: Submit for fabrication and erection of metal fabrications. Indicate profiles, sizes, connection, reinforcing and anchorage.
 - 1. Provide templates for anchorage installation by others.
- C. Railing Design/Build Certificates: Submit certification signed by California licensed structural engineer indicating compliance with Contract Documents and code requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. System Description: Provide stock and custom fabricated metal items.

- B. Steel Shapes, Plates and Bars: ASTM A36.
 - 1. Steel Bar Grating: ASTM A36 or ASTM A1011.
 - 2. Wrought Iron: Maximum 0.3% carbon content with slag mechanically mixed with iron and conforming to ASTM E350 analysis; soft, ductile, and corrosion resistant.
- C. Structural Steel Sheet: Hot rolled, ASTM A1011; or cold rolled, ASTM A1008, Class 1; of grade required for design loading.
- D. Steel Pipe: ASTM A53, Type S seamless, grade as selected by fabricator and as required for design loading; minimum standard weight, STD or Schedule 40.
- E. Steel Tubing: Cold formed ASTM A500; or hot rolled, ASTM A501; minimum Grade B; seamless where exposed.
- F. Castings: Gray iron, ASTM A48, Class 30; malleable iron, ASTM A47.
- G. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron ASTM A47, or cast steel ASTM A27. Provide bolts, washers and shims as required, hot-dip galvanized, ASTM A153.
- H. Grout: Non-shrink meeting ASTM C1107, non-metallic, pre-mixed, factory-packaged, non-staining, non-corrosive; type specifically recommended by manufacturer as applicable to job condition.
- I. Fasteners and Rough Hardware: Type required for specific usage; provide zinc-coated fasteners for exterior use or where built into exterior walls.
- J. Welding Materials: AWS D1.1, type required for materials being welded.
- K. Paint: Provide primers as recommended by paint manufacturers for substrates and paints specified in Section 09 90 00 – Painting and Coating.
 - 1. Galvanizing Repair Paint: High zinc-dust content paint for regalvanizing welds in galvanized steel.

2.2 FABRICATION

- A. Fabricate items with joints neatly fitted and properly secured.
- B. Grind exposed welds continuous, smooth and flush with adjacent finished surfaces, and ease exposed edges to approximate 1/32" uniform radius.
- C. Exposed Mechanical Fastenings: Flush countersunk fasteners unobtrusively located, consistent with design of structure.
- D. Fit and shop assemble in largest practical sections for delivery.
- E. Make exposed joints flush butt type, hairline joints where mechanically fastened.
 - 1. Fabricate joints exposed to weather in manner to exclude water or provide weep holes where water could accumulate.

- F. Supply components required for proper anchorage of metal fabrications; fabricate anchorage and related components of same material and finish as metal fabrication.
- G. Railings: Comply with California and ADA Standards access requirements and NAAMM "Pipe Railing Manual"; welded construction; cap exposed ends.
 - 1. Railing Design Requirements: Design railings to support a lateral force of 50 lbs. /lin. ft. uniform load and 200 lbs. at any single point without permanent set or damage; ASTM E935.
 - a. Top Rails: Design to support minimum 300 lb. concentrated single point load applied at any point vertically or horizontally.
 - 2. Regulatory Requirements:
 - a. Access: Comply with California Building Standards Code and Americans with Disabilities Act (ADA) Standards for access for persons with disabilities.
 - b. Code: Comply with requirements of applicable codes for railing design, except where more restrictive codes are specified.
 - 3. Handrails: Seamless steel tube rails, 1-1/2" outside diameter, continuous railings conforming to applicable code and design requirements.
- H. Fall Protection Roof Eye Bolts: Provide roof tie backs conforming to Title 8, California Code of Regulations, Section 3191(f) for tie-backs for fall protection where applicable.
 - 1. Type: 2" closed eye drop forged hot-dipped galvanized eye bolts, 12'-0" on center.
 - 2. Strength: Set to withstand minimum 5400 lb. tensile load.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible; do not delay job progress; allow for trimming and fitting where necessary.

3.2 ERECTION

- A. Obtain Architect's review prior to site cutting and adjusting which are not part of scheduled work.
 - 1. Perform necessary cutting and altering for installation and coordination with other work.
- B. Install items square and level, accurately fitted and free from distortion or defects detrimental to appearance or performance.
 - 1. Supply items required to be cast into or embedded in other materials to appropriate trades.

2. Ensure alignment with adjacent construction; coordinate with related work to ensure no interruption in installation.
- C. Make provision for erection stresses by temporary bracing; keep work in alignment.
- D. Field bolt and weld to match standard of shop bolting and welding; hide bolts and screws whenever possible, where not hidden, use flush countersunk fastenings.
 1. Perform field welding in accordance with AWS D1.1.
- E. After installation, touch-up field welds and scratched and damaged surfaces; use primer consistent with shop coat or recommended for galvanized surfaces, as applicable.
- F. Replace items damaged in course of installation and construction.

3.3 SCHEDULE

- A. Supply and install metal fabrications listed in Schedule, complete with anchorage and attachments necessary for installation.
 1. Schedule lists principal items only, refer to Drawings for items not listed.
- B. Schedule:
 1. Miscellaneous angles, plates and attachments to be set in concrete or masonry for anchorage of other items.
 2. Iron and steel shapes, sleeves, anchors, connectors and fastenings required to complete construction work, and which are not provided in other Specification sections.
 - a. Rough hardware, including bolts, fabricated plates, anchors, hangers, dowels and miscellaneous metals.
 - b. Ledge and shelf angles, channels and plates not attached to structural steel, and for support of metal decking.
 - c. Angle and channel frames for doors and wall openings.
 - d. Beams of structural shapes not supported by structural steel.
 - e. Steel angle corner guards.
 - f. Elevator sill support angles, and metal fabrications sized on Architectural Drawings not typically provided as part of structural work.
 - g. Elevator sill support angles, hoistway divider beams, and metal fabrications sized on Architectural Drawings not typically provided as part of structural work.
 3. Guard rails and handrails, other than stair railings.
 4. Exit stair safety gates.

5. Ladders.
6. Alternating tread stairs.
7. Steel bar gratings; galvanized finish.
8. Elevator shaft screens.
9. Steel bollards.
10. Cast-in-place concrete stair nosing.
11. Roof eye bolts.
12. Window washing davits and outriggers.
13. Floor access doors.
14. Pre-engineered support systems.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Included: Furnish and install Rough Carpentry required for the project as shown on the Drawings and specified herein. This Section also includes:
1. Structural floor, wall, and roof framing.
 2. Built-up structural beams and columns.
 3. Floor, wall and roof plywood sheathing.
 4. Furring for wall finishes.
 5. Rough hardware.
 6. Blocking for roofing systems and related metal flashings.
 7. Preservative treatment.
 8. Concealed wood blocking and backing for support of accessories, wall cabinets, finish hardware.

- B. Related work specified elsewhere:

1. Concrete Formwork.
2. Metal Fabrications.
3. Glued Laminated Structural Units.
4. Laminated Strand (LSL) Lumber.
5. Laminated Veneer (LVL) Lumber.
6. Parallel Strand (PSL) Lumber.
7. Prefabricated I-Joists.
8. Finish Carpentry.

- 1.2 REFERENCES, CODES AND STANDARDS: The following references, codes and standards are hereby made a part of this Section and rough carpentry work shall conform to the applicable requirements therein except as otherwise specified herein or shown on the Drawings. Nothing contained herein shall be construed as permitting work that is contrary to code requirements.

- A. ALSC (American Lumber Standards Committee) American Softwood Lumber Standard PS-20.
- B. American Wood Council:
1. ANSI/AWS NDS – 2018 National Design Specification for Wood Construction – with 2018 NDS Supplement
 2. ANSI/AWS SPDWS – 2015: Special Design Provisions for Wind and Seismic
 3. Manual for Engineered Wood Construction
- C. APA (American Plywood Association) - Guide to Plywood Grades.
- D. ASTM A307 - Carbon Steel Externally Threaded Standard Fasteners.

- E. ASTM D3498 - Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems.
- F. AWWPA (American Wood Protection Association) – U1: User Specification for Treated Wood
- G. California Building Code, 2022 Edition.
- H. FSC – Forest Stewardship Council, Washington, D.C.
- I. NLMA (National Lumber Manufacturers Association) – National Design Specification for Stress-Grade Lumber and its Fastenings.
- J. WCLIB (West Coast Lumber Inspection Bureau) - Standard Grading Rules No. 17.
- K. WWPAA (Western Wood Products Association) - Western Lumber Grading Rules
- L. Bolts Used in Wood Construction, CDGS – Division of the State Architect, IR 23-5

1.3 QUALITY ASSURANCE

- A. Lumber Grading Agency: Certified by ALSC.
- B. Plywood Grading Agency: Certified by APA.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 30 00.
- B. Product Data: Submit manufacturer's literature describing products.
- C. Samples: Only as requested by the Architect.
- D. Manufacturer's Certificates: Submit certificates of compliance with standards noted.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Store and protect products under provisions of Section 01 60 00.
- B. Provide proper facilities for handling and storage of materials to prevent damage to edges, ends, and surfaces.
- C. Deliver and store packaged products in original containers or bundles with seals unbroken and labels intact until time of use.
- D. Keep materials dry. Where necessary, stack materials off ground on level flat forms, fully protected from weather.
- E. Protect 'kiln-dried' and 'S-Dry' materials from moisture. Separate from contact with soil or earth or other sources of moisture.

PART 2 - PRODUCTS

2.1 LUMBER MATERIALS

- A. Refer to Drawings for schedule.

2.2 PLYWOOD MATERIALS

- A. Refer to Drawings for schedule.

2.3 ACCESSORIES

- A. Rough Hardware: Exterior hardware nails and fasteners shall be hot-dipped galvanized, plain finish for interior locations, size and type to suit application. Nails to be common nails or ICBO approved equivalent, unless authorized otherwise in writing.
- B. Bolts: Hexagonal heads, Grade A conforming to ASTM A307; galvanized for exterior, exposed applications only.
- C. Sill Bolts: Galvanized conforming to ASTM F1554, Grade 36.
- D. Lag Screws and Lag Bolts: Meet requirements of National Design Specifications for Stress Grade Lumber and Its Fastenings.
- E. Washers: Washers for bearing against wood shall be provided under all bolt heads, lag screw heads, and nuts. Malleable iron or steel plate having an area equal to 16 times the area of bolt or lag screw. Steel washers shall have a thickness not less than 1/10 the length of the washer's longest side. Malleable iron washers shall have a thickness not less than 1/2 the bolt or lag screw diameter and having a bearing surface for the nut or head equal in diameter and having a bearing surface for the nut or head equal in diameter to not less than the long diameter of the nut or head.
- F. Powder Driven Fasteners: Tempered steel pins with special corrosive-resistant plating or coating. Pins shall have guide washers to accurately control penetration, maximum 3/4 inch. Fastening shall be accomplished by low-velocity piston-driven powder-actuated tool. Pins and tool shall be same as manufactured by Hilti Fastening Systems; Impex Tool corporation; or equal product substituted under provisions of Section 01 25 00 Substitution Procedures with Request Form.
- G. Expansion Bolts: FS FF-S-325, Group II, Type 4, size as noted. Same as Hilti, Inc. Kwik Bolt 3, or approved equal.
- H. Fabricated Sheet Metal Timber Framing Connectors: Fabricate from hot-dipped galvanized steel. Connectors shall be at least 20 gauge material (1/8 inch plate materials where welded), unless otherwise noted, punched for nailing. Nails and Nailing shall conform to the manufacturer's instructions with a nail provided for each punched hole. Types as noted on the drawings. Same as Simpson Co.; KC metal Products; or equal product substituted under provisions of Section 01 60 00.
- I. Glue: Conforming to ASTM D3498 and APA Performance Specification AFG-01.

2.4 WOOD TREATMENT

A. Materials:

1. Wood Preservative, Pressure Treatment: FS-TT-W-571, AWPB treatment C2 and C9 using either Alkaline Quat (ACQ Type B and D), Copper Azole (CBA-A, CA-B), Sodium Borates (SBX).
2. Wood Preservative, Surface Application: Copper green, manufactured by Willard Products.

B. Shop Treatment of Wood Materials:

1. Provide pressure treatment for lumber other than foundation grade redwood located within 1-1/2 inches of concrete, in contact with bituminous roofing, waterproofing, and related metal flashings, and where noted on Drawings.
2. Lumber: Treat in accordance with AWPB LP-3.
3. Plywood: Treat in accordance with AWPB LP-3.

C. Galvanization

1. Anchor bolts, nails, fasteners, and metal framing connectors in contact with pressure treated lumber shall be hot-dipped galvanized to a rating of G-185 per ASTM A653.

PART 3 - EXECUTION

3.1 SITE TREATMENT OF WOOD MATERIALS

- #### A.
- Apply non-pressure wood preservative to lumber and plywood embedded in and placed against concrete.

3.2 FRAMING

- #### A.
- Erect wood framing members level and plumb.
- #### B.
- Place horizontal members laid flat, crown side up.
- #### C.
- Construct framing members full length without splices.
- #### D.
- Double members at openings over one sq.ft. Space short studs over and under opening to stud spacing.
- #### E.
- Construct double joist headers at floor and ceiling openings. Frame rigidly into joists.
- #### F.
- Make bearings full and finish bearing surfaces to give sure and even support.
- #### G.
- Do not notch, bore, or cut members for pipes, vents, conduits or other reasons except as shown on the Drawings or specifically authorized by the Architect.
- #### H.
- Construct double joists under discontinuous walls.

- I. Coordinate delivery of glue laminated structural units and plywood web joists.
- J. Layout embedded items for entire project.
- K. Shim, strip and furr as necessary to achieve described tolerances.

3.3 BRIDGING

- A. Install solid blocking between joists at points of support and wherever sheathing or flooring is discontinuous.
- B. Blocking may be omitted where joists rests on ribbons and are nailed to studs and where joists are supported on metal hangers.

3.4 SHEATHING

- A. Secure roof sheathing perpendicular to framing members with ends staggered. Secure sheet edges over firm bearing.
- B. Secure wall sheathing vertically parallel to wall studs, with ends staggered, over solid blocking. Secure sheet edges over firm bearing.
- C. Secure subfloor and flat roof sheathing perpendicular to floor framing with end joints staggered. Secure sheet edges over firm bearing. Attach sheathing with subfloor glue and nail as shown.
- D. Nail panel edges to framing members or blocking at least 1-1/2 inches thick. Space nails at panel edges as indicated on drawings, or if not shown, in accordance with CBC requirements. Place nails not less than 3/8 inches from panel edges and drive solidly into the support.

3.5 FASTENING

- A. In general, provide nail penetration into the piece receiving the point of not less than 1/2 the length of the nail or spike provided; however, 16d nails may be used to connect two pieces of 2 inch (nominal) thickness.
- B. In diaphragms, the minimum penetration shall be 1-1/2 inches for 8d nails and 1-5/8 inches for 10d nails.
- C. Perform nailing without splitting wood, preboring as required; replace split members.
- D. Drill bolt holes 1/16 inches larger in diameter than the bolts being used; drill straight and true from one side only.
- E. Bolt threads must not bear on wood; use washers under head and nut where bolts bear on wood; use washers under nuts.
- F. Lag screw anchorage embedment in piece lagged to shall not be less than 0.6 times lag screw length nor less than 8 times lag screw diameter.
- G. Prebore holes for lag screws same diameter as root of thread; enlarge holes to shank diameter for length of shank.

- H. Do not drive lag screws.

3.6 MISCELLANEOUS ROUGH CARPENTRY

- A. Install miscellaneous blocking, furring, cants, nailing strips, framing and sheathing.
- B. Install members true, plumb, and level. Secure in place.
- C. Space miscellaneous framing and furring at 16 inches o.c.
- D. Construct members of continuous pieces of longest possible lengths.

3.7 TOLERANCES

- A. Framing Members: 1/4 inch maximum from true position.
- B. Surface Flatness of Floor: 1/4 inch in 10 feet maximum.

END OF SECTION

SECTION 06 10 50

MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide miscellaneous wood blocking and plywood, including blocking for roofing system and related flashing.
 - 1. Provide plywood panel boards.
 - 2. Preservative treat wood members as indicated.
- B. Related Sections:
 - 1. Section 06 20 00: Finish carpentry.
 - 2. Section 06 40 00: Architectural woodwork.

1.2 REFERENCES

- A. Forest Products Society (FPS): National Design Specification for Stress Grade Lumber and its Fastening.

1.3 SUBMITTALS

- A. Product Data: Submit wood treatment certifications and instructions for proper use of each type of treated material.
- B. Wood Product Certification: Furnish certification indicating wood products are from "well-managed" forests.

1.4 QUALITY ASSURANCE

- A. Lumber Grades: Provide visible grade stamp of an agency certified by FPS.
- B. Lumber Standard: Comply with US Product Standard PS20 for each indicated use, including moisture content and actual sizes related to indicated nominal sizes.
- C. Plywood Standard: Comply with PS1 (ANSI A199.1).
- D. Certified Wood Products: Wood products to be from forests certified "well-managed" by an agency accredited by Forest Stewardship Council (FSC) including SmartWood Program and Forest Conservation Program.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. System Requirements: Provide miscellaneous wood blocking and plywood, including blocking for roofing system and related flashing.

- B. Regulatory Requirements: Comply with applicable code requirements for miscellaneous rough carpentry.
- C. Blocking: Provide dimensional lumber graded in accordance with FPS Grading Rules; Construction Grade, Douglas Fir; minimum S-Dry.
- D. Plywood: Provide minimum APA C-D exterior (CDX) plywood; stress rated where spanning between supporting members; fire retardant treated; minimum 3/4" thick unless otherwise indicated.
- E. Plywood Panel Boards: Provide panel boards for electrical and communication panel boards; APA C-D plugged, interior type plywood with exterior glue, fire retardant treated; minimum 1/2" thick.
- F. Nails, Spikes and Staples: Galvanized; size and type to suit application.
- G. Bolts, Nuts, Washers, Lags, Pins and Screws: Medium carbon steel; galvanized; size and type to suit application.
- H. Fasteners: Provide fasteners as required for complete, secure installation of miscellaneous rough carpentry.
 - 1. Solid Masonry or Concrete: Expansion shield and lag bolt type.
 - 2. Steel: Bolts or powder activated type.

2.2 FABRICATION

- A. Wood Preservation: Treat lumber and plywood to comply with applicable requirements of American Wood Preservers Association and applicable codes.
 - 1. Decay Resistance Treatment: Pressure treat wood in accordance with AWP A U1 using preservative chemicals acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 - a. Treat wood members based on AWP A U1 Use Categories as appropriate to Project location and exposure.
 - b. Kiln-dry wood to a maximum moisture content of 19% after treatment with water-borne preservative.
 - 2. Fire Retardant Treatment: Comply with AWP A standards for pressure impregnation with fire-retardant chemicals to achieve flame-spread rating of not more than 25 in accordance with ASTM E84 or UL Test 723.
 - a. Treat interior wood and plywood complying with applicable code requirements for Interior FRTW.
 - 1) Exterior Type: Where indicated for exterior applications, provide fire treated wood passing ASTM D2898 rain test.
 - b. Provide UL label on each piece of fire-retardant wood and plywood.

- c. Kiln-dry treated items to maximum moisture content of 19%.
- 3. Complete fabrication of treated items prior to treatment, wherever possible; if cut after treatment, coat cut surfaces with heavy brush coat of same chemical used for treatment.
- 4. Inspect each piece after drying and discard damaged and defective pieces.

PART 3 - EXECUTION

3.1 PLACEMENT

- A. Place miscellaneous rough carpentry true to lines and levels.
- B. Correlate location so attached work will comply with design requirements and be properly located.
- C. Construct members of continuous pieces of longest possible lengths.
- D. Fit carpentry work to other work; scribe and cope as required for accurate fit.
- E. Shim with metal or slate for bearing on concrete and masonry.
- F. Securely attach carpentry work to substrates by anchoring and fastening as required by recognized standards.
 - 1. Provide washers under bolt heads and nuts in contact with wood.
- G. Wood Blocking: Provide blocking of S4S lumber not less than 1-1/2" wide and of thickness required to provide adequate support or to properly locate attached material.
 - 1. Provide attachment to other work; form to shapes shown.
 - 2. Countersink bolts and nuts flush with surfaces.
 - 3. Remove temporary blocking when no longer needed.
 - 4. Anchor to formwork before concrete placement.
 - 5. Build into masonry as work progresses, cutting to fit masonry unit size involved.
- H. Plywood: Comply with recommendations of American Plywood Association (APA) for fabrication and installation of plywood work.

END OF SECTION

SECTION 06 20 00

FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide finish carpentry with accessories as required for complete installation.

1. Provide wood trellises.
2. Provide wood louvers.
3. Provide wood fences and gates.
4. Provide wood trim.
5. Provide wood door jambs.
6. Provide wood polymer composite decking.
7. Provide composite wood shutters.
8. Provide closet and storage shelving.
9. Provide closet poles.
10. Provide Janitor closet mop holders.

- B. Related Sections:

1. Section 06 40 00: Architectural woodwork; casework, countertops, and paneling.
2. Section 12 33 00: Manufactured residential casework.

1.2 REFERENCES

- A. North American Architectural Woodwork Standards 3.1 (NAAWS).

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination, Wood Jambs: Coordinate wood door jambs with Section 08 14 00 – Wood Doors for pre-hung wood doors.

1.4 SUBMITTALS

- A. Product Data: Submit literature for manufactured items.
- B. Shop Drawings: Indicate materials and wood species, component profiles, fastening, and joining details, finishes, and accessories.
- C. Samples: Furnish samples of each type of finish carpentry.
- D. Assurance Options: NAAWS certification and monitored compliance programs will not be required for finish carpentry.
- E. Wood Product Certification: Furnish certification indicating wood products are from FSC “well-managed” forests.

1.5 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control for adhesives, sealants, and caulks, and for composite wood products formaldehyde limitations.
- B. Certified Wood Products: Wood products to be from forests certified “well-managed” by an agency accredited by Forest Stewardship Council (FSC).

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver materials until site conditions are adequate to receive work; protect items from weather while in transit.
- B. Store materials indoors, in ventilated areas with constant but minimum temperature of 60-degrees F and maximum relative humidity of 25% to 55%.
- C. Do not begin installation of finish carpentry until space is fully enclosed and mechanical systems are fully operational.
 - 1. Maintain interior installation areas at 70-degrees F and 50% to 55% relative humidity.
- D. Immediately remove from site materials with visible mold and materials with mildew.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. System Description: Provide finish carpentry systems specified complying with North American Architectural Woodwork Standards (NAAWS) and including accessories as required for complete installation.
- B. Wood Trellises, Louvers, Fences, and Gates:
 - 1. Quality: NAAWS/Premium Grade for natural finish.
 - 2. Wood: Clear Western Red Cedar.
 - 3. Wood: Clear Douglas Fir.
 - 4. Cut: Mixed Grain.
 - 5. Texture: Surfaced.
 - 6. Texture: Rough Sawn.
 - 7. Gate Hardware: Provide exterior commercial quality gate hardware appropriate to applications indicated and including latching devices, spring closers, pivots, and devices required to secure gates both open and closed.
- C. Transparent Finished Exterior Wood Trim and Jambs:

1. Quality: NAAWS/Premium Grade.
2. Wood: Clear Western Red Cedar.
3. Wood: Clear Douglas Fir.
4. Cut: Vertical Grain.
5. Cut: Flat Grain.
6. Cut: Mixed Grain.
7. Texture: Surfaced.
8. Texture: Rough Sawn.

D. Opaque Painted Exterior Wood Trim and Jambs:

1. Quality: NAAWS/Custom Grade.
2. Wood: Clear Western Red Cedar.
3. Wood: Clear Douglas Fir.
4. Cut: Mixed Grain.
5. Texture: Surfaced.
6. Texture: Rough Sawn.

E. Transparent Finished Interior Wood Trim and Jambs:

1. Quality: NAAWS/Premium Grade.
2. Wood: Red Oak.
3. Wood: White Birch.
4. Cut: Vertical Grain.
5. Cut: Flat Grain.
6. Cut: Mixed Grain.
7. Texture: Surfaced.

F. Opaque Painted Interior Wood Trim and Jambs:

1. Quality: NAAWS/Custom Grade.
2. Wood: White Birch or Poplar.
3. Wood: Pine.

4. Wood Trim: Medium density fiberboard (MDF), formaldehyde-free and toxic-free.
 5. Wood Jambs: Pine; finger jointed Pine acceptable.
 6. Texture: Surfaced.
- G. Wood Polymer Composite Decking: Composite of waste hardwood fiber and recycled and reclaimed polyethylene.
1. Manufacturer:
 - a. Trex Company/Trex Wood Polymer Lumber.
 - b. Nexwood Industries Ltd./Nexwood.
 - c. Substitutions: Refer to Section 01 25 00.
 2. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
- H. Composite Wood Shutters: Provide manufactured composite of waste hardwood fiber and recycled and reclaimed polyethylene in shapes and sizes indicated for wood shutters.
1. Quality: Comparable to AWI/Premium Grade; Refer to AWI Section 1200.
 2. Manufacturer:
 - a. Trex Company/Trex Wood Polymer Lumber.
 - b. Nexwood Industries Ltd./Nexwood.
 - c. Substitutions: Refer to Section 01 25 00.
 3. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
- I. Wood Shelving: Provide wood board shelves, minimum 3/4" thick.
1. Quality: NAAWS/Custom Grade, for opaque paint finish.
 2. Fixed Wood Shelf Supports: NAAWS/Custom Grade, softwood for opaque finish.
 3. Adjustable Shelf Supports and Brackets:
 - a. Standard Duty: Single slotted standards with slots 1" on center and standards spaced maximum 24" on center; brackets for minimum 12" deep shelves unless otherwise indicated.
 - b. Heavy Duty: Single slotted standards with slots 2" on center and standards spaced maximum 24" on center, brackets for minimum 12" deep shelves unless otherwise indicated.
 - c. Extra Heavy Duty: Double slotted standards with slots 2" on center and standards spaced maximum 24" on center, brackets for minimum 12" deep shelves unless otherwise indicated.

- d. Finish: Manufacturer standard as selected by Architect.
- J. Wood Closet Poles: Standard 1-3/8" wood closet poles with end brackets; provide intermediate brackets where over 4'-0" long.
- K. Metal Closet Poles: Provide metal tube units with end brackets; provide intermediate brackets where recommended by manufacturer; bright chromium finish.
 - 1. Manufacturers:
 - a. Knappe & Vogt Mfg Co./660 Stainless Steel Pole, 734-735 brackets.
 - b. Substitutions: Refer to Section 01 25 00.
 - 2. Manufacturers:
 - a. Knappe & Vogt Mfg Co./770-1 Chrome Closet Pole, 734-735 brackets.
 - b. Substitutions: Refer to Section 01 25 00.
 - 3. Manufacturers:
 - a. Knappe & Vogt Mfg Co./No. 2 Extension Closet Rod.
 - b. Stanley Works/Adjustable round closet bar 7050.
 - c. Substitutions: Refer to Section 01 25 00.
- L. Coated Wire Closet and Storage Shelving: Provide coated steel wire shelf system with integral pole, including connections, supports, and accessories as required for complete installation in configurations indicated on Drawings; with 12" shelf depth.
 - 1. Manufacturers:
 - a. Newell Rubbermaid/Freeslide Ventilated Wire Shelving.
 - b. Clairson International/Closetmaid SuperSlide Shelving with Hang Bar.
 - c. LeeRowan/FreeSlide Ventilated Wire Shelving.
 - d. Substitutions: Refer to Section 01 25 00.
- M. Janitor Closet Mop Holders: Spring loaded anti-slip mop holders with rubber cam, with three mop holders on stainless steel.
 - 1. Manufacturers:
 - a. Bobrick Washroom Equipment, Inc./Model B-223.
 - b. Bradley Corp./Model 9953.
 - c. American Specialties Inc./Model 0796A.
 - d. Substitutions: Refer to Section 01 25 00.
- N. Anchors, Nails and Screws: Select the material, type, size and finish required by each substrate for secure anchorage; provide toothed steel or lead expansion bolt screws for drilled-in-place anchors.
- O. Wood Filler: Color to match wood being filled.

2.2 FABRICATION

- A. Fabricate finish carpentry items in accordance with specified quality standard.
- B. Use exposed fastening devices or nails only when approved and unavoidable; arrange neatly.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication where possible; do not delay job progress, allow for trimming and fitting.
- B. Verify surfaces are ready to receive work and field measurements are as shown on shop drawings.
 - 1. Beginning installation signifies acceptance of conditions.
- C. Ensure mechanical and electrical items affecting work are properly placed, complete, and have been inspected by applicable authorities prior to commencement of installation.
- D. Inspect each piece of finish carpentry and discard damaged and defective pieces.

3.2 INSTALLATION

- A. Install work consistent with specified NAAWS quality grade, plumb, level, true and straight with no distortions; shim as required, using concealed shims.
 - 1. Prime paint surfaces in contact with cementitious materials prior to installation; comply with requirements of Section 09 90 00 – Painting and Coating.
- B. Secure work to blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation.
- C. Scribe and cut for accurate fit to other finished work.
- D. Install finish carpentry in single, unjointed lengths for openings and for runs less than 10'-0".
 - 1. For longer runs, use only one piece less than 10'-0" in any straight run; provide scarf joints between members.
 - 2. Stagger joints in adjacent members.
 - 3. Cope at returns and miter at corners.
- E. Accessories: Install accessories in accordance with manufacturer's recommendations in locations indicated or as directed by Architect.
- F. Acceptable Tolerances:

1. Variation from True Position: Maximum 1/16" at any position and maximum 1/8" in any 10'-0" length.
2. Adjoining Surfaces of Same Material: No variation permitted.
3. Offset with Abutting Materials: Maximum 1/32".

G. Preparation for Field Finishing:

1. Sand work smooth and set exposed nails and screws.
2. Apply wood filler in exposed nail and screw indentations and leave ready to receive site-applied finishes.
3. Seal concealed and semi-concealed surfaces; brush apply only, using primer consistent with finish coats specified under Section 09 90 00 – Painting and Coating.

END OF SECTION

SECTION 06 40 00

ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide mill fabricated architectural woodwork with accessories as required for complete finished installation including cabinetwork hardware.
 - 1. Provide custom wood cabinetwork.
 - 2. Provide countertops.
- B. Related Sections:
 - 1. Section 06 10 50: Miscellaneous rough carpentry.

1.2 REFERENCES

- A. North American Architectural Woodwork Standards, 3.1 (NAAWS).

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's literature for manufactured items.
- B. Shop Drawings: Indicate materials and wood species, component profiles, fastening, joining details, finishes, and accessories.
 - 1. Certification: Provide Woodwork Institute Certified Compliance Label on shop drawings.
- C. Samples: Furnish samples of each exposed finish.
 - 1. Veneers: After approval of type of wood for veneer submit not less than three potential flitches of matching wood veneers to be reviewed by Architect each with enough veneering available for Project.
 - a. Where Architect cannot visit location of flitch do factory floor layout of flitch indicating total appearance on casework and submit photographs with true color of each flitch.
 - 2. Furnish samples of each exposed casework hardware.
 - 3. Furnish samples of wood paneling showing corner and edge treatment.
- D. Wood Product Certification: Furnish certification indicating wood products are from FSC "well-managed" forests.

1.4 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control for adhesives, sealants, and caulks, for composite wood products formaldehyde limitations, and for paints and coatings.
- B. Fabricator Qualifications: Member of Sponsor of North American Architectural Woodwork Standards with minimum five years successful experience fabricating woodwork like that required for Project.
- C. Standards: Perform architectural woodwork in accordance with North American Architectural Woodwork Standards (NAAWS).
 - 1. Certified Compliance Program (CCP): Comply with Woodwork Institute "Certified Compliance Program (CCP)" as defined in NAAWS.
 - 2. Monitored Compliance Program (MCP): Comply with Woodwork Institute "Monitored Compliance Program (MCP)" as defined in NAAWS.
 - 3. Certified Seismic Installation Program (CSIP): Comply with Woodwork Institute Certified Seismic Installation Program.
 - a. Seismic Anchorage: Provide seismic anchorage for wall cabinets as required by California Code of Regulations (CCR), Title 24, Part 2.
- D. Certified Wood Products: Wood products to be from forests certified "well-managed" by an agency accredited by Forest Stewardship Council (FSC).
- E. Field Sample: Provide one full size field sample of base and wall cabinet and countertop, including drawer, doors and shelves.
- F. Seismic Anchorage: Provide seismic anchorage for wall cabinets as required by California Code of Regulations (CCR), Title 24, Part 2.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver architectural woodwork until site conditions are adequate to receive work; protect items from weather while in transit.
 - 1. Allow architectural woodwork shop finish to completely dry prior to delivery to site; allow materials to off-gas volatile organic compound (VOC) emissions off site.
- B. Store materials indoors, in ventilated areas with constant but minimum temperature of 60-degrees F and maximum relative humidity of 25% to 55%.
- C. Do not begin installation of architectural woodwork until space is fully enclosed and mechanical systems are fully operational.
 - 1. Maintain interior installation areas at 70 degrees F and 50% to 55% relative humidity.
- D. Immediately remove from site materials with visible mold and materials with mildew.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. System Description: Provide mill fabricated architectural woodwork with accessories as required for complete finished installation including cabinet hardware.
- B. Transparent/Stained Finished Casework:
 - 1. Quality: NAAWS/Premium Grade frameless, flush overlay unless otherwise indicated.
 - a. Special: Provide each single length section of casework in largest such sections as access and openings allow.
 - 1) Multiple self-supporting units fastened together to form larger unit allowed only where access and openings do not allow single lengths.
 - 2. Veneers: As indicated under Finishing; approved by Architect; a uniform appearance shall be required.
 - a. Exposed Exterior and Exposed Interior Veneer Thickness: Minimum 0.036" thick.
 - b. Semi-Exposed Surfaces: White Birch stained to match exterior veneers; melamine interior is not acceptable.
 - 3. Wood Core: Plywood or medium density fiberboard (MDF) or particleboard, with no added formaldehyde and free of toxic materials.
 - 4. Exposed Edges: Wood matching veneer.
- C. Opaque Finished Wood Casework:
 - 1. Quality: NAAWS/Custom Grade frameless, flush overlay, unless otherwise indicated.
 - a. Special: Provide each single length section of casework in largest such sections as access and openings allow.
 - 1) Multiple self-supporting units fastened together to form larger unit allowed only where access and openings do not allow single lengths.
 - 2. Veneer: NAAWS/Paint Grade White Birch, minimum 0.036" thick.
 - 3. Wood Core: Plywood or medium density fiberboard (MDF) or particleboard, with no added formaldehyde and free of toxic materials.
 - 4. Exposed Edges: Hardwood.

D. Plastic Laminate Finished Casework and Countertops:

1. Quality: NAAWS/Custom Grade frameless, flush overlay, unless otherwise indicated.
 - a. Special: Provide each single length section of casework in largest such sections as access and openings allow.
 - 1) Multiple self-supporting units fastened together to form larger unit allowed only where access and openings do not allow single lengths.
 2. Plastic Laminates:
 - a. Types: NEMA LD-3.1 high pressure laminates.
 - 1) Horizontal Surfaces: General Purpose Type, nominal 0.050".
 - 2) Vertical Surfaces: Vertical Surface Type, nominal 0.032".
 - 3) Unexposed Surfaces: Balanced with 0.030" melamine backing sheet.
 - 4) Formed Surfaces: Postforming Type, nominal 0.042".
 - b. Manufacturers:
 - 1) Formica Corp.
 - 2) Wilsonart, Wilsonart Engineered Surfaces.
 - 3) Nevamar Corp.
 - 4) Abet Laminati Co.
 - 5) Substitutions: Refer to Section 01 25 00.
 - c. Solid Color Laminates:
 - 1) Formica Corp./ColorCore2.
 - 2) Wilsonart, Wilsonart Engineered Surfaces/Solicore.
 - 3) Abet Laminati Co/Solid Colors.
 - 4) Substitutions: Refer to Section 01 25 00.
 - d. Chemical Resistant Laminates:
 - 1) Wilsonart, Wilsonart Engineered Surfaces/Chemsurf.
 - 2) Nevamar/Chemarmor Chemical Resistant Decorative Laminate.
 - 3) Arborite/ArboChem.
 - 4) Substitutions: Refer to Section 01 25 00.
 - e. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
 3. Wood Core: Plywood or medium density fiberboard (MDF) or particleboard, with no added formaldehyde and free of toxic materials.
- E. Casework Hardware: Provide casework hardware items as required for complete installation as indicated; provide types as listed in North American Architectural Woodwork Standards for casework, but no less than following types.

1. Plug-In Pin Type Shelf Supports (Transparent Finished Casework): Match BHMA A156.9 B04013 spoon type plug-in supports; provide holes 1" on center.
2. Adjustable Shelf Standards and Supports (Plastic Laminate and Opaque Painted Casework): Match BHMA A156.9 B04073 adjustable standards and B04083 closed shelf rest brackets for mortis mounting; flush mounted in cabinet.
3. Cabinet Hinges: BHMA A156.9 B01602 or B01603 frameless European concealed type, minimum 160 degree opening, with spring closer.
4. Cabinet Hinges: BHMA A156.9 B01602 or B01603 frameless European concealed type, minimum 160 degree opening, without spring closer.
5. Cabinet Hinges: BHMA A156.9 B014xx pivot (knife) type, polished chrome finish.
6. Cabinet Pulls: As indicated, as directed by Architect where not indicated.
7. Cabinet Pulls: Back mounted wire type, 3" center to center, clear aluminum; as approved by Architect.
8. Cabinet Pulls: Back mounted wire type, 3-1/2" center to center, clear aluminum; as approved by Architect.
9. Cabinet Pulls: Back mounted wire type, 4" center to center, clear aluminum; as approved by Architect.
10. Cabinet Pulls: Back mounted wire type, 5" center to center, clear aluminum; as approved by Architect.
11. Drawer Slides: Full extension, rail mounted type, minimum 100 lb. capacity with ball-bearing rollers; self-closing.
 - a. Manufacturers:
 - 1) Accuride.
 - 2) Knappe & Vogt.
 - 3) Blum.
 - 4) Hettich International.
 - 5) Substitutions: Refer to Section 01 25 00.
12. Cabinet Locks: Pin and tumbler slide bolt lock with five pin tumblers as approved by Architect, two keys each.
13. Magnetic Catches: BHMA 156.9 B03141.
- F. Solid Polymer Countertops: Manufacturer's standard polymer system with color throughout thickness; provide manufacturer recommended joint adhesive; exposed surfaces finished to match top.
 1. Manufacturers:
 - a. DuPont Co./Corian.
 - b. Avonite, Inc./Avonite.
 - c. Formica Corp./Surell.

- d. Chemcore Industries/Dovae.
 - e. Substitutions: Refer to Section 01 25 00.
 - 2. Quality: NAAWS/Premium Grade.
 - 3. Type: Not less than 1/2" thick sheet; coordinate with bowls as indicated and as specified in Division 22.
 - 4. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
- G. Quartz-Based Solid Polymer Countertops: Manufacturer's standard quartz-based polymer system with color throughout thickness; provide manufacturer recommended joint adhesive; exposed surfaces finished to match top.
- 1. Manufacturers:
 - a. CaesarStone USA/CaesarStone.
 - b. Silstone USA/Silstone Countertops.
 - c. DuPont Co./Zodiaq.
 - d. Cambria USA/Cambria Countertops.
 - e. Substitutions: Refer to Section 01 25 00.
 - 2. Quality: NAAWS/Premium Grade.
 - 3. Type: Not less than 1/2" thick sheet; coordinate with bowls as indicated and as specified in Division 22.
 - 4. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
- H. Chemical Resistant Epoxy Countertops: Chemical resistant epoxy solid surface system with color throughout thickness; provide manufacturer recommended joint adhesive; exposed surfaces finished to match top.
- 1. Manufacturers:
 - a. ChemTops/Epoxy Resin Countertops, chemical resistant.
 - b. Duratop/Epoxy Countertops, chemical resistant.
 - c. Keur Industries/Epoxy Resin Counter Tops; chemical resistant.
 - d. Substitutions: Refer to Section 01 25 00.
 - 2. Quality: NAAWS/Premium Grade.
 - 3. Type: Designed with integral bowls.
 - 4. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
- I. Cultured Marble: Comply with requirements of ANSI/CMI Z124, Property and Performance Standards for Cultured Marble Lavatories.
- 1. Tops: Certified by Cultured Marble Institute (CMI).

2. Lavatories: Integral bowl type, with cutouts for plumbing fixtures.
 3. Edges: Finish exposed edges.
 4. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
- J. Special "Sintered Stone" Neolith Countertops: Manufacturer's standard countertop material with color throughout thickness and standard "Silk" finish.
1. Quality: NAAWS/Premium Grade for natural finish.
 2. Supplier: Neolith Countertops (www.NeolithCountertops.com) not less than 12mm thick.
 3. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
- K. Wood Base for Tile Countertops:
1. Quality: NAAWS/Economy Grade.
 2. Wood Core: Plywood, medium density fiberboard (MDF) or particleboard, with no added formaldehyde and free of toxic materials.
 3. Tile: Provided under Section 09 30 00 - Tiling.
 - a. Comply with Tile Council of North America (TCNA) recommendations for materials and fabrication of wood base for tile counters.
- L. Transparent/Stained Finished Wood Paneling:
1. Quality: NAAWS/Premium Grade, type as indicated.
 2. Veneer: As indicated under Finishing; approved by Architect; a uniform appearance shall be required.
 - a. Thickness: Minimum 0.036" thick.
 3. Paneling Wood Core: Fire rated medium density fiberboard (MDF) with no added formaldehyde and free of toxic materials; type passing ASTM E84 with maximum flame spread of 200 and maximum smoke density of 450.
 - a. Fire Retardant Treatment: Type which does not bleed through and which does not adversely affect finishes.
 4. Exposed Edges: Hardwood matching veneer.
- M. Shop Fabricated Wood Stairs: Provide complete prefabricated wood stair system with treads, risers, skirts, wedges, glue blocks, trim and accessories as required for complete, squeak free wood stair system.
1. Quality: NAAWS/Premium Grade, for opaque paint finish.

2. Wood: As approved by Architect; solid wood at exposed edges.
- N. Shop Fabricated Wood Railings: Provide wood railing systems with handrails, balusters, newels and trim as required for complete wood railing system.
 1. Quality: NAAWS/Premium Grade, for opaque paint finish.
 2. Wood: Hardwood handrails, other wood as approved by Architect.
- O. Anchors, Nails and Screws: Select material, type, size and finish required by each substrate for secure anchorage; provide toothed steel or lead expansion bolt screws for drilled-in-place anchors.
- P. Wood Filler: Color to match wood being filled.

2.2 FABRICATION

- A. General: Fabricate architectural woodwork in accordance with specified North American Architectural Woodwork Standards.
- B. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Make corners and joints hairline; slightly bevel arises.
 1. Locate butt joints at least 2'-0" from cutouts.
 2. Cap exposed edges with plastic laminate of same finish and pattern.
 3. Apply laminate backing sheet to reverse side of laminate surfaces.
 4. Provide cutouts for inserts, fixtures and fittings; verify locations from on-site dimensions.
 5. Prime paint contact surfaces of cutouts.
 6. Plastic Laminate Countertops: Square butt joints and self edging; applied plastic or metal edging not permitted.
 - a. Splashes as indicated or as directed by Architect where not otherwise indicated.
- C. Countertops: Provide maximum sizes available. Locate butt joints at least 2'-0" from cutouts where more than one-piece countertops are required.
 1. Make corners and joints hairline; slightly bevel arises.
 2. Provide cutouts for inserts, fixtures and fittings; verify locations from on-site dimensions.
 3. Splashes and edges as indicated or as directed by Architect where not otherwise indicated.

- D. Use exposed fastening devices or nails only when approved and unavoidable; arrange neatly.
- E. Assemble woodwork in shop in sizes easily handled and to ensure passage through building openings.

2.3 FINISHES

- A. Transparent/Stained Finished Woodwork: Finish architectural woodwork in shop unless otherwise indicated.
 - 1. Wood Veneers: As indicated on Drawings; match Architect samples.
 - 2. Wood Veneers: Vertical grain select rift cut white oak; filled, bleached, glazed, and sealed; match Architect approved sample.
 - 3. Veneering:
 - a. Matching Between Veneer Pieces: Slip matched.
 - b. Matching of Panel Faces: Balanced matched.
 - c. Matching of Panels and Components: Sequenced matched.
 - 4. Sand work smooth; seal, stain and varnish concealed and semi-concealed surfaces of transparent/stained finished woodwork; brush apply.
 - 5. Transparent/Stained Finish: NAAWS/Premium Grade water-based polyurethane finish producing a dull rubbed effect, as approved by Architect.
- B. Opaque Finished Woodwork: Shop finish unless otherwise indicated.
 - 1. Sand work smooth; seal, stain and varnish concealed and semi-concealed surfaces of opaque finished woodwork; brush apply.
 - 2. Opaque Finish: NAAWS/Premium Grade opaque "lacquer" producing semi-gloss sheen as approved by Architect.
 - 3. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
- C. Opaque Finished Woodwork: Field finished under Section 09 90 00 - Painting and Coating.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication where possible; do not delay job progress, allow for trimming and fitting.

3.2 INSTALLATION

- A. Install work consistent with Architectural Woodwork Standards specified quality grade, plumb, level, true and straight with no distortions.
 - 1. Shim as required, using concealed shims.
- B. Ensure mechanical and electrical items affecting architectural woodwork are properly placed, complete, and have been inspected by Architect prior to commencement of installation.
- C. Secure work to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation.
- D. Scribe and cut for accurate fit to other finished work.
- E. Install architectural woodwork under supervision of factory-trained mechanics.
- F. Attach architectural woodwork securely in place with uniform joints providing for thermal and building movements.
- G. Paneling: Provide fire-treated wood stops eight feet on center at paneling where required by applicable codes when paneling is not direct applied to substrate.
- H. Acceptable Tolerances:
 - 1. Variation from True Position: Maximum 1/16" at any position and maximum 1/8" in any 10'-0" length.
 - 2. Adjoining Surfaces of Same Material: No variation permitted.
 - 3. Offset with Abutting Materials: Maximum 1/32".
- I. Preparation for Field Finishing:
 - 1. Sand work smooth and set exposed nails and screws.
 - 2. Apply wood filler in exposed nail and screw indentations and leave ready to receive site-applied finishes.
 - 3. Seal concealed and semi-concealed surfaces; brush apply only, using primer consistent with finish coats specified under Section 09 90 00 - Painting and Coating.

END OF SECTION

SECTION 07 13 00

SHEET WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide self-adhesive sheet membrane waterproofing system, including sealing joints and protrusions through waterproofing, with protective board, drainage composite covering, and accessories for complete watertight installation.
- B. Related Sections:
 - 1. Section 07 16 00: Cementitious and reactive waterproofing at elevator pits.
 - 2. Section 07 28 00: Weather barrier/underlayment including sheet membranes.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's literature for waterproofing system and protection board.
- B. Shop Drawings: Indicate flashings, joints, sealing at openings, projections, and waterproofing of holes, slots and sleeves.
- C. Certificates: Submit manufacturer's representative's certification work has been installed in accordance with manufacturer's recommendations.

1.3 QUALITY ASSURANCE

- A. Qualification of Installers: Minimum five years successful experience in projects of similar scope.

1.4 SITE CONDITIONS

- A. Do not apply waterproofing during inclement weather or when air temperature is below 40 degrees F, except where specifically authorized by manufacturer's representative for specific materials.
- B. Do not apply waterproofing to damp, dirty, dusty, or otherwise unsuitable surfaces.
 - 1. Allow concrete surfaces to cure minimum 28 days.

1.5 WARRANTY

- A. Extended Correction Period: Provide for correcting failure of system to resist water penetration except where failure is result of structural failure of building. Repair system and pay for or replace damaged materials and surfaces.
 - 1. Hairline cracking due to temperature or shrinkage is not considered structural failure.

2. Period: Two years.
- B. Manufacturer's Warranty: Submit manufacturer's warranty including special manufacturer services as required for manufacturer's warranty.
 1. Period: 5 years.
 2. Manufacturer's warranty shall not detract from requirements of extended correction period nor from Owner's rights under implied and expressed warranties regardless of wording of manufacturer's warranty.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. GCP Applied Technologies (Grace) /Bituthene 3000 or 4000 Waterproofing System.
- B. Carlisle Coatings and Waterproofing/CCW Miradri Waterproofing.
- C. Polyguard Products, Inc./Polyguard No. 650.
- D. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide sheet membrane waterproofing system including sealing joints and protrusions through waterproofing, protective covering, and accessories.
- B. Regulatory Requirements: Provide materials conforming to applicable air quality management district limitations on volatile organic compound (VOC) emissions.
- C. Waterproofing System: System consisting of sheet membrane of rubberized asphalt and polyethylene film, total thickness approximately 60 mil, and fluid applied rubberized asphalt for sealing system.
 1. Low Temperature Applications: Where temperatures are between 25 degrees F and 40 degrees F, use manufacturer's special membrane and primer for low temperature applications.
- D. Primer: Manufacturer's recommended primer of applications involved; primer is required for waterproofing applications.
- E. Crack and Expansion Joint Sealants: Types as recommended by waterproofing system manufacturer, compatible with waterproofing system.
- F. Protective Covering:
 1. Protection Board: Preformed asphalt impregnated board or similar protective cover recommended by waterproofing manufacturer.
 - a. Vertical Applications: Minimum 1/8" thick protective cover.
 - b. Horizontal Applications: Minimum 1/4" thick protective cover.

2. Drainage Composite: Formed plastic with filter fabric designed to allow penetration and drainage of water while retaining silts, soils, and similar particulate matter; type recommended by manufacturer for application.
 - a. Manufacturers:
 - 1) Waterproofing manufacturer.
 - 2) Grace/Hydroduct Drainage Composite.
 - 3) Carlisle/CCW MiraDRAIN.
 - 4) Colbond, Inc./Enkadrain.
 - 5) Substitutions: Refer to Section 01 25 00.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare surfaces in accordance with manufacturer's recommendations.
- B. Ensure sleeves, curbs and projections which pass through waterproofing are properly and rigidly installed.
- C. Ensure surfaces are free of cracks, depressions, waves and projections which may be detrimental to proper installation of waterproofing.
 1. Repair surfaces as required by manufacturer's representative.
- D. Seal cracks and expansion joints with recommended backup material and sealant; ensure proper depth-width ratio as recommended by sealant manufacturer.
- E. Ensure expansion joints are sharply formed, free of broken edges and loose aggregates.
- F. Clean surfaces of dust, dirt and foreign matter detrimental to proper installation of waterproofing.
- G. Prime surfaces to receive waterproofing in accordance with manufacturer's recommendations.

3.2 INSTALLATION

- A. Apply waterproofing in accordance with manufacturer's recommendations and installation instructions as required for watertight installation.
 1. Seal joints and items projecting through waterproofing.
- B. Seam Overlap: Minimum 2-1/2".
 1. Stagger end laps.
- C. Reinforce corners with double applications of waterproofing unless otherwise specifically recommended by manufacturer's representative.

- D. Allow extra materials at joints with anticipated movement to permit movement without stressing waterproofing.
- E. Roll waterproofing membrane smooth, firmly and completely to surfaces indicated, with no fish-mouths or bunches of material.
- F. Inspect and repair waterproofing in accordance with manufacturer's instructions prior to application of protection board and backfill.
- G. As soon as possible after installation and inspection apply protection boards and drainage composites in accordance with manufacturer's recommendations.
 - 1. Neatly fit around pipes and penetrations.

3.3 FIELD QUALITY CONTROL

- A. Site Flood Test: Test horizontal applications of waterproofing before completed membrane is covered by protection course or other work.
 - 1. Test for leaks with 2" depth of water maintained for 24 hours; do not overload structure.
 - 2. Repair leaks revealed by examination of substructure and repeat test until no leakage is observed.
- B. Manufacturer's Field Services: Manufacturer's representative shall inspect work of Project on regular basis and provide certification waterproofing has been installed in accordance with manufacturer's recommendations.
 - 1. Provide unobstructed access to waterproofing work.
 - 2. Correct defects and irregularities as advised by manufacturer's representative.

END OF SECTION

SECTION 07 21 00

THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide thermal batt insulation with integral vapor retarder and accessories as required for complete installation.
- B. Related Work:
 - 1. Section 09 21 00: Acoustical insulation concealed in gypsum board systems.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Interior Vapor Retarders: Where specifications require foil faced vapor retarders as part of building thermal insulation system, intent is to prevent migration of spores from mold and mildew into interior building spaces.
 - 1. Intent is to provide air barrier and vapor retarder on interior surface while allowing vapor to move through exterior wall vapor permeable surfaces, while vapor permeable water barriers are maintained at exterior side of wall.

1.3 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature for each type of insulation.
 - 1. Submit Underwriter's Laboratory approval numbers for required fire ratings; approvals of other laboratories contingent upon acceptance of applicable authorities.

1.4 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to energy efficiency.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. System Description: Provide thermal batt insulation with integral vapor retarder and accessories.
- B. Thermal Batt Insulation: Preformed slag mineral or glass fiber with thermosetting resin binders, conforming to ASTM C665; formaldehyde-free.
 - 1. Manufacturers:
 - a. Johns Manville/FSK-25 Thermal-Shield Insulation.
 - b. Owens-Corning Fiberglas Corp./Fiberglas FS-25 Insulation.
 - c. CertainTeed/Thermafiber FS25 Insulation.

- d. Substitutions: Refer to Section 01 25 00.
 - a. Johns Manville/Thermal-Shield Insulation.
 - b. Owens-Corning Fiberglas Corp./Fiberglas Insulation.
 - c. CertainTeed/Thermafiber Insulation.
 - d. Substitutions: Refer to Section 01 25 00.
- 2. R-Value: Minimum R-19 at walls, R-38 at horizontal surfaces, unless otherwise indicated.
- 3. Flame Spread/Smoke Developed Rating: Maximum 25/450, ASTM E84.
- 4. Vapor Retarder: Type III, aluminum vapor retarder on one side.
- 5. Vapor Retarder: Type I: No vapor retarder.
- 6. Combustibility: Pass ASTM E136.
- C. Penetration Type Insulation Supports: Galvanized or electroplated steel penetration supports with adhesive attachment to substrate and support disc.
- D. Vapor Retarder Tape: Minimum 2" wide self-adhering type designed to maintain vapor retarder integrity and complying with fire resistance ratings as required by applicable codes.
- E. Accessories: Furnish as recommended by insulation manufacturer for insulation types, substrates, and conditions involved.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify substrate and adjacent materials are dry and ready to receive insulation; beginning installation signifies acceptance of conditions.
- B. Ensure mechanical and electrical items affecting work are properly placed, complete, and have been inspected by Architect prior to commencement of installation.

3.2 INSTALLATION

- A. Install insulation in accordance with manufacturer's instructions with vapor retarder toward inside of building.
- B. Cut and trim insulation neatly, to fit spaces.
 - 1. Backed Insulation: Use insulation free of ripped backs and edges.
- C. Fit insulation tight within spaces and tight to and behind mechanical and electrical services within insulation plane; leave no gaps or voids; maintain integrity of thermal barrier.
- D. Friction fit in place; use tape or penetration supports as necessary to assure permanent installation.

1. Taping: Tape perimeters, joints, and tears in vapor retarder, including joints between insulation and surrounding construction, to ensure vapor-tight installation.
2. Penetration Supports: Cut or bend pins in locations accessible to maintenance personnel, to eliminate potential hazards from exposed pin points.

END OF SECTION

SECTION 07 26 00

BELOW-GRADE VAPOR RETARDER

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide vapor retarder system for below grade and slab-on-grade concrete, including sealing joints and protrusions through vapor retarder and sand bed below vapor retarder.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's literature.

1.3 SITE CONDITIONS

- A. Do not apply vapor retarder during inclement weather or when air temperature is below 40 degrees F.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Fortifiber Corp./Ultra 15.
- B. Raven Industries, Inc./Vapor Block # VB 15 (15 mil Blue).
- C. Stego Industries, Inc./Stego Wrap (15 mil).
- D. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description Includes: Provide vapor retarder system for below grade and slab-on-grade concrete, including sealing joints and protrusions through vapor retarder and sand bed below vapor retarder.
- B. Vapor Retarder: ASTM E1745, Class A vapor retarder consisting of 15 mil polyolefin film.
 - 1. Permeance: Maximum 0.025 perms, ASTM F1249 and E154 tests.
 - 2. Resistance to Puncture: Minimum 2200 grams, ASTM D1709, Method B.
 - 3. Tear Resistance: Minimum 8.74 lbs., ASTM D1004.
 - 4. Tensile Strength: Minimum 35 lbs/in., ASTM E154, Section 9, Method D-882, in both directions.

- C. Joint Sealer: Pressure sensitive tape as recommended by vapor retarder manufacturer and providing comparable permeance to vapor retarder.
- D. Sand Bed: Clean natural sand; free from silt, clay, loam, friable or soluble materials, and organic matter.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Ensure sleeves, curbs and projections that penetrate vapor retarder are properly and rigidly installed.
- B. Ensure substrate is free of projections and irregularities that may be detrimental to proper installation of vapor retarder.

3.2 INSTALLATION

- A. Spread and roll sand to provide smooth, even bed for vapor retarder.
- B. Apply vapor retarder in accordance with manufacturer's recommendations and installation instructions and in accordance with ASTM E1643; comply with most restrictive where conflicts occur.
 - 1. Seal items projecting through vapor retarder with pressure sensitive tape.
- C. Seams: Minimum 12" overlap, sealed with pressure sensitive tape for vapor tight seal.
- D. Lay vapor retarder membrane smooth with no fish-mouths or bunches of material.
- E. Inspect and repair vapor retarder prior to application of concrete slab; tape tears and repair damage.

END OF SECTION

SECTION 07 28 00

WEATHER BARRIER/UNDERLAYMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide weather barrier/underlayment air and water barrier systems for siding, sloped roofing, flashing and sheet metal, and penetrations with accessories as required for complete watertight installation.
1. Wall Underlayment: Provide No. 15 building paper underlayment and flashing for wall applications, with related concealed metal flashings and accessories as required for complete watertight installation.
 2. Wall Underlayment: Provide two layers Grade D building paper underlayment and flashing for wall applications, with related concealed metal flashings and accessories as required for complete watertight installation.
 3. Wall Underlayment: Provide vapor permeable fluid applied underlayment and flashing for exterior wall applications, with related concealed metal flashings and accessories as required for complete airtight and watertight installation.
 4. Wall Underlayment: Provide vapor permeable self-adhering sheet underlayment and flashing for exterior wall applications, with related concealed metal flashings and accessories as required for complete airtight and watertight installation.
 5. Rainscreen Wall Underlayment: Provide combined underlayment and rainscreen system with protection from ultra-violet exposure with accessories as required for complete airtight and watertight installation.
 6. Rainscreen Cover: Provide separate material over wall underlayment system designed to increase flow of water back to exterior of wall assembly and, where necessary to protect underlayment from ultra-violet exposure through open joints.
 7. Sloped Roofing Underlayment: Provide self-adhering sheet membrane underlayment at sloped roofing systems, with accessories as required for complete watertight installation.
 8. Flashings and Sheet Metal Underlayment: Provide self-adhering sheet membrane underlayment at flashings and sheet metal, with accessories as required for complete watertight installation.
 9. Self-Adhering Sheet Membrane (SASM) Flashing at Penetrations: Provide SASM flashing for around penetrations through building paper including windows and doors, with accessories as required for complete watertight installation.
- B. Related Sections:
1. Section 07 60 00: Exposed metal flashing.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Weather Barriers: Provide weather barrier/underlayment systems which, with other building components, comply with applicable code requirements for air barriers and water barriers.
 - 1. Air Barriers: Air barriers shall be as defined by applicable Energy Code requirements and shall include standard exterior wall components and air seal joint sealants specified in Section 07 90 00 – Joint Sealants.
 - 2. Water Barriers: Water barriers shall be as defined by applicable Building Code requirements and shall include vapor permeable systems with or without rainscreen barriers intended to extend amount of water drained to exterior.
 - a. Rainscreen systems can also provide protection from ultra-violet degradation of underlayment where open joint systems are used.
 - 3. Interior Vapor Retarders: Where specifications require foil faced vapor retarders as part of building thermal insulation system, intent is to prevent migration of spores from mold and mildew into interior building spaces.
 - a. Intent is to provide air barrier and vapor retarder on interior surface while allowing vapor to move through exterior wall vapor permeable surfaces, while vapor permeable water barriers are maintained at exterior side of wall.
 - 4. Self-Adhering Flexible Flashings: Intent of flexible flashings at window openings, door openings, and other wall penetrations is to ensure water cannot move from exterior surface past water barriers and into building.
- B. Pre-Installation Meeting: Convene one week prior to commencing work; require attendance of parties directly affecting underlayment.
 - 1. Review procedures and coordination required with related work.

1.3 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature for each type of underlayment.
- B. Samples: Furnish samples of each material.

1.4 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control for adhesives.

1.5 WARRANTY

- A. Extended Correction Period: Provide for correcting failure of system to resist damage from anticipated sources including damage from water penetration. Repair system and pay for or replace damaged materials and surfaces.
 - 1. Period: Two years.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. System Description: Provide weather barrier/underlayment air and water barrier systems for siding, sloped roofing, flashing and sheet metal, and penetrations with accessories.
- B. Regulatory Requirements: Provide materials conforming to applicable air quality management district limitations on volatile organic compound (VOC) emissions.
- C. Regulatory Requirements: Provide materials with minimum volatile organic compound (VOC) emissions available.
- D. Wall Underlay: Unperforated asphalt saturated organic felt, conforming to ASTM D226, Type I, and ASTM D4869 commonly referred to as No. 15.
- E. Wall Underlayment: Provide two layers Grade D water-vapor permeable kraft building paper conforming to Fed Spec UU-B-790a, Type I, Style 2, Grade D with 60-minute water resistance rather than 10 minutes.
 - 1. Manufacturers:
 - a. Fortifiber Building Systems Group.
 - b. Davis Wire.
 - c. Hal Industries.
 - d. Substitutions: Refer to Section 01 25 00.
- F. Wall Underlay: Provide vapor permeable fluid applied air and water barrier underlayment system for complete watertight installation as recommended by manufacturer for substrates and applications indicated.
 - 1. Manufacturers:
 - a. GCP Applied Technologies (Grace)/Perm-A-Barrier VPO Fluid Applied.
 - b. Henry Company/Air-Bloc VP.
 - c. Carlisle Corp./CCW LiquiFiber-W.
 - d. Substitutions: Refer to Section 01 25 00.
 - 2. Provide specific membrane types as recommended by system manufacturers for each type of application.
- G. Wall Underlay: Provide vapor permeable water barrier type self-adhering sheet underlayment system for complete watertight installation as recommended by manufacturer for substrates and applications indicated.
 - 1. Manufacturers:
 - a. GCP Applied Technologies (Grace)/Perm-A-Barrier VPS Self-Adhering Sheet.
 - b. Henry Company/Blueskin SA and SA HT Air and Weather Barrier.
 - c. Carlisle Corp./CCW 705 MSDS.
 - d. Substitutions: Refer to Section 01 25 00.

2. Provide specific membrane types as recommended by system manufacturers for each type of application.
- H. Wall Underlay, Rainscreen, and UV Protection for Open Joint Exterior Cladding: Provide complete vapor permeable self-adhering water barrier, rainscreen, and UV protection system.
1. Manufacturers:
 - a. VaproShield USA/VaproShield System.
 - b. DuPont/Tyvek UV Façade System.
 - c. Substitutions: Refer to Section 01 25 00.
 2. Provide specific membrane, rainscreen, UV joint protection, and accessory materials as recommended by system manufacturer.
- I. Rainscreen Drainage System: Provide system that allows moisture entering wall from exterior and condensation within wall to travel downward and exit wall area; nominal 1/8" to 1/4" thick.
1. Manufacturers:
 - a. Benjamin Obdyke/Slicker Rainscreen.
 - b. Masonry Technology Inc./Sure Cavity Rainscreen Drainage Plane.
 - c. Spycor Building Products/Mortairvent Rainscreen.
 - d. Archovations Inc./Rainscreen Drainage Mat.
 - e. Substitutions: Refer to Section 01 25 00.
 2. Insect Protection: Where not integral within rainscreen drainage system include material designed to prevent insect intrusion into wall through rainscreen drainage system such as Spycor Building Products/Delta Bug Screen.
- J. Sloped Roofing Underlayment: Self-adhering rubberized sheet membrane with primers and seam sealers as required for complete watertight installation; type as recommended by manufacturer for substrate and for applications indicated.
1. Manufacturers:
 - a. GCP Applied Technologies (Grace).
 - b. Henry Company.
 - c. Carlisle Corp.
 - d. Protecto Wrap Company.
 - e. Substitutions: Refer to Section 01 25 00.
 2. Provide specific membrane types as recommended by system manufacturers for each type of application.
- K. High Temperature Metal Roofing Underlayment: Self-adhering sheet membrane with primers and seam sealers as required for complete watertight installation; type as recommended by manufacturer for substrate and for applications indicated.
1. Manufacturers:

- a. GCP Applied Technologies (Grace).
 - b. Henry Company.
 - c. Substitutions: Refer to Section 01 25 00.
- L. Sloped Roofing Underlay: Provide two layers unperforated asphalt saturated organic felt, conforming to ASTM D4869, commonly referred to as No. 30 saturated roof felt.
- M. Sheet Metal and Flashing Underlayment: Self-adhering rubberized sheet membrane with primers and seam sealers as required for complete watertight installation; type as recommended by manufacturer for substrate and for applications indicated.
 - 1. Manufacturers:
 - a. GCP Applied Technologies (Grace).
 - b. Henry Company.
 - c. Carlisle Corp.
 - d. Protecto Wrap Company.
 - e. Substitutions: Refer to Section 01 25 00.
 - 2. Provide specific membrane types as recommended by system manufacturers for each type of application.
- N. Self-Adhering Sheet Membrane (SASM) Flashing at Penetrations: SASM with primers and seam sealers as required for complete watertight installation; type as recommended by manufacturer for substrate and for applications indicated.
 - 1. Manufacturers:
 - a. GCP Applied Technologies (Grace).
 - b. Henry Company.
 - c. Carlisle Corp.
 - d. Protecto Wrap Company.
 - e. Substitutions: Refer to Section 01 25 00.
 - 2. Provide specific membrane types as recommended by system manufacturers for each type of application.
- O. Concealed Metal Flashings Integral with Underlayment: Minimum 26 gage thick steel with minimum 0.90 oz/sf galvanized coating; ASTM A653.
 - 1. Fasteners: Standard round wire type of hot dipped galvanized steel; minimum 19/64" head diameter and 0.104" shank diameter; minimum 7/8" long.
- P. Bituminous Paint: Acid and alkali resistant type; black color.
- Q. Accessories: Provide as recommended by underlayment manufacturers for specific applications.
 - 1. Plastic Cement: Cutback asphaltic type with mineral fiber components, for sealing and coating flashings; free of toxic solvents and free of asbestos. Capable of setting within 24 hours at temperatures of approximately 75 degrees F and 50% R.H.

2.2 FLASHING FABRICATION

- A. Fabricate metal flashings as recommended by Sheet Metal and Air Conditioning Contractors National Association (SMACNA) "Sheet Metal Manual".
- B. Form flashings to drain water to exterior at roofing and siding construction for penetrations, sill and header flashings.
- C. Form sections square, true and accurate to size, in maximum possible lengths and free from distortion and other defects detrimental to appearance or performance.
- D. Hem exposed edges of metal flashings minimum 1/4" on underside.
- E. Apply bituminous paint on concealed surfaces of metal flashings.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Install underlayment over surfaces that are dry, free of ridges, warps and voids that could damage paper.
- B. Coordinate installation with installation of components and items projecting through underlayment.

3.2 FLASHINGS INSTALLATION

- A. Install flashings as recommended by Sheet Metal and Air Conditioning Contractors National Association (SMACNA) "Sheet Metal Manual".
- B. Weatherlap joints minimum 2" and seal with plastic cement; secure in place.
- C. Fastenings: Concealed in completed installation.

3.3 UNDERLAYMENT INSTALLATION

- A. Install weather barrier/underlayment in accordance with installation instructions and recommendations of each manufacturer and of manufacturers of products to cover weather barrier/underlayment; comply with applicable code requirements.
 - 1. Wall Underlayment: Provide one-layer No. 15 building paper underlayment.
 - 2. Wall Underlayment: Provide two-layers Grade D building paper underlayment.
 - 3. Wall Underlayment: Provide fluid applied underlayment.
 - 4. Wall Underlayment: Provide one-layer sheet membrane underlayment.
 - 5. Sloped Roofing: Provide one-layer sheet membrane underlayment.
 - 6. Flashing and Sheet Metal: Provide one-layer sheet membrane underlayment.

7. Penetrations: Apply one-layer of self-adhering sheet membrane extending minimum 18" from penetrations, including windows and doors; start at bottom of penetration and weatherlap joints.
 - a. Apply top layer over metal flashing to direct water to exterior.
 8. Weatherlap joints as recommended by system manufacturer.
 - a. Weatherlap joints not less than 2" at building paper.
 9. Secure underlayment in place, stagger joints between sheet membrane layers; lap ends minimum 6"; stagger end joints.
- B. Building Paper Underlayment: Prime substrates and roll sheet membrane underlayment smooth, firmly and completely to surfaces indicated, with no fish-mouths or bunches of material.
1. Apply plastic cement to substrate prior to application of underlayment starter strips to prevent capillary movement of water back up beneath underlayment.
 2. Weatherlap items projecting through building paper underlayment and seal with plastic cement.
- C. Sheet Membranes: Weatherlap items projecting through sheet membrane underlayment and seal with sealer recommended by sheet membrane underlayment manufacturer.

END OF SECTION

SECTION 07 31 10

ASPHALT SHINGLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide asphalt/fiber glass composition shingle roofing system with accessories as required for complete, weathertight installation.
- B. Related Sections:
 - 1. Section 07 28 00: Weather barrier/underlayment.
 - 2. Section 07 60 00: Flashing and sheet metal.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Pre-Installation Meeting: Convene pre-construction meeting one week prior to roofing work to coordinate roofing with other trades; require attendance of parties directly affecting roofing work.
 - 1. Review installation and coordination required with related work.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's literature for roofing and accessories.
- B. Samples: Submit samples of composition shingles.

1.4 QUALITY ASSURANCE

- A. Qualification of Installer: Acceptable to system manufacturer and with minimum five years successful experience with similar size and type projects.
- B. Mock-Up: Provide 200 square foot mock-up, including ridge and hip, to be approved by Architect; approved mock-up may be incorporated into Project.

1.5 WARRANTY

BUILD-IT GREEN REQUIRES 3 YEAR SUBCONTRACTOR WARRANTY AND 20 YEAR MANUFACTURER WARRANTY FOR SHINGLE ROOFING SYSTEMS.

- A. Extended Correction Period: Provide for correcting failure of system to resist damage from anticipated sources including damage from wind and water penetration. Repair system and pay for or replace damaged materials and surfaces.
 - 1. Period: Three years.

3-TAB SHINGLES ONLY OFFER UP TO 25 YEAR MANUFACTURER WARRANTY, BUILD-IT GREEN REQUIRES 20 YEAR MANUFACTURER WARRANTY FOR SHINGLE ROOFING SYSTEMS.

- B. Manufacturer's Warranty: Submit manufacturer's warranty including special manufacturer services as required for manufacturer's warranty.
 - 1. Period: 20 years.
 - 2. Manufacturer's warranty shall not detract from requirements of extended correction period nor from Owner's rights under implied and expressed warranties regardless of wording of manufacturer's warranty.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. GAF-Elk Corporation.
- B. Owens-Corning Fiberglas Corp.
- C. CertainTeed.
- D. Substitutions: Refer to Section 01 25 00.

2.2 ROOFING MATERIALS

- A. System Description: Provide asphalt/fiber glass composition shingle roofing system with accessories.
- B. Regulatory Requirements:
 - 1. Cool Roof System: Comply with California Building Standards Code requirements for "Cool Roof" system including three-year aged solar reflectance value requirements.
 - a. Label: System to have Cool Roof Rating Council (CRRC) label.
 - 2. Fire Resistance: System to be Class A listed by Underwriters Laboratories for roof materials covering.
 - 3. Wind Resistance: Provide system capable of resisting anticipated wind uplift based on slopes indicated.
 - a. Provide system with UL "Wind Resistant" label.
- C. Shingles: Fiberglass and asphalt composition roofing shingles; conforming to ASTM D3462, and ASTM D3018, Type 1; shingles bearing UL Class A fire and "Wind Resistant" labels.

SELECT FROM FOLLOWING TYPICAL SHINGLE SYSTEMS, MODIFY WARRANTY WHERE OTHER THAN 30 YEAR.

1. Type: Laminated fiberglass and asphalt shingle with "Slate" appearance as approved by Architect; type with not less than 30-year manufacturer warranty (manufacturer warranty not required).
 2. Type: Laminated fiberglass and asphalt shingle with "Shake" appearance as approved by Architect; type with not less than 40-year manufacturer warranty (manufacturer warranty not required).
 3. Type: Standard three-tab shingles; minimum weight 215 lbs/square.
 4. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
- D. Underlayment: Provided in Section 07 28 00 – Weather Barrier/Underlayment.
- E. Nails: Standard barbed shank round wire shingle type of hot dipped zinc coated steel; minimum 3/8" head diameter, 11 or 12-gage; minimum 1-1/4" long.
- F. Accessories: Provide as indicated and as required for complete weathertight installation.
1. Ridge Vents: Provide low profile continuous ridge vents suitable for application indicated; type covered with roof shingles; type as approved by Architect.
- G. Plastic Cement: Cutback asphaltic type with no asbestos content, for sealing and coating flashings in buildings; free of toxic solvents and free of asbestos.
1. Provide material capable of setting within 24 hours at temperatures of approximately 75 degrees F and 50-percent relative humidity.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect underlayment application; install composition roofing over dry surfaces free of ridges, warps and voids.
1. Take special care not to damage underlayment beyond that required to secure roofing to substrate.
- B. Coordinate installation of roofing with installation of roof-mounted components, flashings and items projecting through roofing.
- C. Ensure roof openings are properly sized and located prior to roofing installation.

3.2 INSTALLATION

- A. Install roofing shingles in accordance with manufacturer's recommendations and installation instructions, as required to meet specified fire and wind requirements.
1. Coursing Pattern: As approved.

2. Conform to requirements of applicable codes.
 3. Ridge Vents: Comply with manufacturer recommendations and installation instructions.
- B. Conceal fastenings in completed installation of roofing.
 - C. Flash and seal items projecting through or mounted on roofing with plastic cement.
 - D. Provide complete weathertight roof installation.

END OF SECTION

SECTION 07 46 40

FIBER CEMENT SIDING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide fiber reinforced cement siding with accessories for complete weathertight installation.
- B. Related Sections:
 - 1. Section 07 28 00: Weather barrier/underlayment.

1.2 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature.
- B. Shop Drawings: Indicate fabrication details, connection details, pertinent dimensions, and erection support points.
 - 1. Show precise locations of exposed fasteners, including drawings scaled to indicate exposed fastener patterns.
- C. Samples: Submit sample of each type of panel with finish required.

1.3 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control for paints and coatings.
- B. Qualification of Installer: Firm with minimum five years successful experience installing architectural fiber cement building panels.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store in manufacturer's wrapping and crating.

1.5 WARRANTY

- A. Extended Correction Period: Extend correction period to two years.
 - 1. Repair or replace defective siding that fails through corrosion or finish damage because of manufacturing defects.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. James Hardie Building Products.
- B. GAF Materials Corp./GAF-ELK WeatherSide.
- C. Plycem USA, Inc./Allura.
- D. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description Provide fiber cement siding with accessories.
- B. Fiber Cement Panels: Provide systems as indicated on Drawings; not less than ASTM C1186, Type A with label listing an approved quality control agency per code.
 - 1. Plank System: Match Hardie/Hardiplank, fiber-reinforced cement panels, with no asbestos content.
 - a. Thickness: Preformed 5/16" thick.
 - b. Finish: Smooth surface.
 - c. Size: 9-1/2" width (8-1/4" coverage), with planks available in up to 12'-0" lengths.
 - 2. Panel System: Match Hardie/Hardipanel, fiber-reinforced cement panels, with no asbestos content.
 - a. Thickness: Preformed 5/16" thick.
 - b. Finish: Smooth surface.
 - c. Size: 4'-0" width by lengths appropriate for application, including 8', 9', and 10' lengths as required to minimize joints.
 - 3. Panel Soffits and Trim: Match panel system as indicated and as required for complete installation.
 - 4. Factory Prime Finish: Provide factory primed fiber cement panels using primer compatible with paints and coatings specified in Section 09 90 00 – Painting and Coating.
 - 5. Shop Finish: Provide manufacturer's premium quality shop painted finished materials.
 - a. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.

6. Fasteners: Corrosion resistant non-magnetic stainless-steel siding nails; types as recommended by system manufacturer.
 7. Exposed Fastener Heads: Types as approved by Architect.
- C. Accessories: Provide as indicated, as recommended by panel manufacturer and as required for complete finished siding installation.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Install siding over surfaces which are dry, free of ridges, warps and voids.
- B. Coordinate installation of siding with installation of items projecting through; ensure openings are properly sized and located prior to siding installation.
- C. Underlayment: Take special care not to damage underlayment beyond that required to secure siding to structure.

3.2 INSTALLATION

- A. Provide for installation procedures, temporary bracing and induced loads during erection; maintain temporary bracing in place until final support is provided.
 1. Coordinate with building paper installation in Section 07 28 00; take special care not to damage building paper beyond required penetrations for fasteners.
- B. Install siding in accordance with manufacturer recommendations and installation instructions, without damage to panel, panel shape or finish.
 1. Carefully locate exposed fasteners to conform to Architectural Drawings and approved shop drawings; exposed fasteners to provide uniform pattern as approved.
- C. Erect level, plumb, square, and true within allowable tolerances.
- D. Align and maintain uniform horizontal and vertical joints, as erection progresses.
- E. Securely fasten units in place.
- F. Seal exposed fastener heads using materials matching mineral-fiber cement siding and strike flush to match adjacent surfaces.
- G. Site Tolerances: Maintain following joint tolerances of erected mineral-fiber units:
 1. Face Width of Joint: Maximum plus or minus 1/16" (total 1/8").
 2. Jog in Alignment of Edges: Maximum 1/8".

3.3 CLEANING

- A. Clean marks, debris, and dirt from exposed surfaces of mineral-fiber units using manufacturer recommended cleaning materials and procedures which do not stain nor damage panels or fasteners.

END OF SECTION

SECTION 07 52 00

MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide two ply modified bitumen roofing system consisting of SBS modified bitumen base and mineral surfaced cap sheet, base and cant flashings, perlite fiber cants, and accessories for complete weather-tight installation.
- B. Related Sections:
 - 1. Section 06 10 50: Miscellaneous rough carpentry.
 - 2. Section 07 60 00: Flashing and sheet metal.

1.2 REFERENCE STANDARDS

- A. National Roofing Contractors Association (NRCA): The NRCA Roofing and Waterproofing Manual.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Pre-Installation Meeting: Convene not less than one week prior to commencing work of this section. Require attendance of parties directly affecting roofing work.
 - 1. Review procedures and coordination required with related work.

1.4 SUBMITTALS

- A. Product Data: Submit literature for roofing system and each type of material; list each material proposed on Project.
- B. Shop Drawings: Include tapered and non-tapered insulation layout along with R-value calculations.
- C. Samples: Submit finished roof surface.
- D. Manufacturer Certificates:
 - 1. Submit certificate installer is approved for roof system installation.
 - 2. Submit certification materials and components furnished conform to Specification requirements and are compatible with each other, roof substrate, and related work, and are suitable for applications indicated.
 - 3. Fire and Wind: Submit manufacturer's certification system conforms to fire and wind requirements.
 - 4. Submit manufacturer's representative's certification work has been installed in accordance with manufacturer recommendations.

1.5 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to energy efficiency.
- B. Installer Qualifications: Roofing manufacturer certified or approved.
- C. Supervisor: Installer to maintain full-time supervisor/foreman who is on jobsite during roofing work who is experienced in installation of roofing system specified.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect foam insulation from direct sunlight exposure.

1.7 SITE CONDITIONS

- A. Do not apply roofing membrane during inclement weather or when air temperature may fall below 40 degrees F, taking into consideration added wind chill factor.
 - 1. Do not allow materials to be exposed to moisture during transportation, storage, handling or installation.
 - 2. Mark damp or wet materials, including felts which froth or foam during installation, and remove from site within 24 hours.
- B. Do not apply roofing membrane to damp, frozen or unsuitable deck surface.
 - 1. Allow time for moisture from previous precipitation, fog or dew to evaporate before proceeding with roofing work.
- C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

1.8 WARRANTY

- A. Extended Correction Period: Provide for correcting failure of system to resist damage from anticipated sources including damage from wind and water penetration. Repair system and pay for or replace damaged materials and surfaces.
 - 1. Period: Two years.
- B. Manufacturer's Warranty: Submit manufacturer's warranty including special manufacturer services as required for manufacturer's warranty.
 - 1. Period: 20 years.
 - 2. Manufacturer's warranty shall not detract from requirements of extended correction period nor from Owner's rights under implied and expressed warranties regardless of wording of manufacturer's warranty.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Johns Manville Roofing Systems.
- B. GAF Materials Corp.
- C. MB Technology.
- D. CertainTeed, Saint-Gobain.
- E. Soprema USA.
- F. Siplast, Inc.
- G. Substitutions: Refer to Section 01 25 00.
 - 1. Manufacturers listed under specific products are acceptable in addition to primary roofing material manufacturers.

2.2 MATERIALS

- A. System Description: Provide two ply modified bitumen roofing system consisting of SBS modified bitumen base and mineral surfaced cap sheet, base and cant flashings, perlite fiber cants, and accessories.
 - 1. Provide roofing system materials by a single manufacturer, except where materials of other manufacturers are specified or approved by Architect.
 - 2. Provide roof insulation, double layer application where indicated.
 - 3. Provide tapered insulation as required to ensure not less than 1/4" per foot slopes to drains-
- B. Regulatory Requirements
 - 1. Cool Roof System: Comply with California Building Standards Code requirements for "Cool Roof" system including three-year aged solar reflectance value requirements.
 - a. Label: System to have Cool Roof Rating Council (CRRC) label.
 - 2. Fire and Wind Resistance: Conform to California Building Standards Code requirements for Underwriters Laboratory (UL) Class A roof system, with UL Class 60 wind resistance classification.
 - a. Provide materials conforming to code requirements for roof/ceiling 1-hour fire resistive rating for components and materials indicated in Contract Documents.

- C. Modified Bitumen Roofing System: Provide minimum two ply, styrene-butadiene-styrene (SBS) modified bitumen system with integral granule surfacing designed for hot mop or cold adhesive application (torch-on system not acceptable).
 - 1. NRCA Specification: Comply with following for minimum requirements, in addition to manufacturer's system.
 - a. Insulated Deck: MBSH-2-I-M/L-M, two SBS ply system.
 - 2. SBS Sheets: Manufacturer's standard non-woven polyester reinforced styrene-butadiene-styrene sheets for specified system.
 - a. Wood Deck: Provide additional asphalt impregnated glass fiber base sheet where over wood deck.
 - 3. Asphalt: Minimum ASTM D312, type recommended for application.
 - 4. Base Sheet at Wood: Minimum ASTM D2178, Type VI, glass felt base sheet.
 - 5. Flashing System: Manufacturer's premium quality granule faced modified bitumen flashing system (torch applied systems are acceptable for flashings).
 - a. Color: Where available, provide Architect with full selection of available colors.
- A. Roof Insulation: ASTM C1289, Type II, Class 1, Grade 2 glass fiber faced isocyanurate, with ASTM C1303 Long Term Thermal Resistance (LTTR) not less than R-38.
 - 1. Manufacturers:
 - a. Johns Manville/UltraGard.
 - b. GAF/Isotherm.
 - c. CertainTeed/FlintBoard ISO.
 - d. Substitutions: Refer to Section 01 25 00.
- B. Tapered Insulation: Conform to ASTM C728.
 - 1. Manufacturers:
 - a. Johns Manville/Fesco or UltraGard Tapered Roof Insulation.
 - b. GAF/EnergyGuard Tapered Roof Insulation.
 - c. CertainTeed/FlintBoard ISO Tapered Roof Insulation.
 - d. Koppers Inc./Perlite Tapered Roof Insulation.
 - e. Substitutions: Refer to Section 01 25 00.
- C. Roof Deck Board: Provide as indicated, as required for uniform surface for membrane adherence, and as required for fire and wind ratings.
 - 1. Manufacturers:
 - a. Georgia Pacific/DensDeck Prime.
 - b. Johns Manville/Securock.
 - c. Substitutions: Refer to Section 01 25 00.

- D. Cant and Edge Strips: Conform to ASTM C208.
 - 1. Manufacturers:
 - a. Johns Manville/Fesco Cant & Edge Strips.
 - b. GAF/EnergyGuard Cant and Edge Strips.
 - c. Koppers Inc./Perlite Cant and Edge Strips.
 - d. Substitutions: Refer to Section 01 25 00.
- E. Mechanical Fasteners: As recommended by insulation manufacturer and meeting recommendations of NRCA and specified Quality Assurance requirements for fire rating and wind blow-off resistance.
- F. Roof Protection Pads: Provide protection materials as recommended by membrane manufacturer where maintenance traffic is anticipated over membrane.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect roof deck to ensure deck is clean and smooth, free of depressions, waves or projections, and is properly sloped to drains, valley, or eaves.
- B. Ensure roof openings and curbs, and pipes, sleeves, ducts or vents through roof are solidly set, cant strips and reglets in place and nailing strips located.
- C. Inspect roofing materials to ensure they are dry at time of installation.
- D. Apply roofing over clean, dry, and warm surfaces during fair weather.

3.2 PREPARATION

- A. Protect surrounding surfaces against damage from roofing work.
- B. Where hoisting is necessary, hang tarpaulins to protect walls.

3.3 INSTALLATION

- A. Install membrane roofing system in accordance with manufacturer's recommendations and instructions and as required to meet requirements for warranty and applicable codes.
 - 1. Comply with NRCA Specification Guide for Modified Bituminous Membrane Roofing as applicable; where conflicts exist comply with manufacturer's recommendations.
- B. Insulation Application: Provide multiple layer insulation with plastic insulation separated from roofing by roof deck board.
 - 1. Place insulation boards butted in close contact; stagger joints between insulation board layers.

2. Bevel insulation to allow snug fit at penetrations; cut neatly around protrusions through roof.
 3. Install tapered insulation, cants and edge strips in accordance with manufacturer's instructions and NRCA recommendations.
- C. Roof Deck Board: Install in accordance with manufacturer recommendations and as required to ensure suitable substrate for membrane roofing over insulation, fire ratings, and wind ratings; secure to roofing deck.
1. Place roof deck boards butted in close contact; stagger joints between roof deck board and insulation board joints.
 2. Cut to allow snug fit at penetrations; cut neatly around protrusions through roof.
 3. Leave no insulation exposed at end of day's work; apply glaze coat of hot bitumen and two plies of felt over insulation and install cut-off weather-tight.
- D. Roof Membrane Application: Apply using hot-mopped method, torch-applied method acceptable for flashing systems only.
1. Apply roofing membrane in accordance with manufacturer's instructions for roof type specified.
 2. Wood Deck: Where applied directly to wood deck mechanically fasten one layer of glass fiber reinforced base sheet prior to application of two ply modified bitumen roofing system.
 - a. Comply with manufacturer recommendations for installation of base sheet.
 - b. Apply base sheet smooth, free from air pockets, wrinkles, fish-mouths, prominent lap-joints, and tears.
- E. Apply two ply SBS roof membrane system smooth, free from air pockets, wrinkles, fish-mouths, prominent lap-joints, and tears.
1. Carry roof membrane up cant strips to vertical surfaces and secure to nailing strips and reglets.
 2. Comply with manufacturer's recommendations for installation of base, wall and field flashings.
 3. Install waterproof cut-off at "end of day" operation.
 4. Coordinate metal flashings and counterflashing.
 5. Coordinate installation of roof drains and related flashings.
 6. Mop in and seal flashings and flanges of items projecting through membrane.
- F. Roof Protection Pads: Secure roof protection pads in place in accordance with membrane manufacturer recommendations and as required to ensure protection of membrane from roof maintenance traffic.

1. Set pads to allow roof drainage; where pads cross drainage path set with not less than 4" and not more than 8" between pads.

3.4 FIELD QUALITY CONTROL

- A. Hot Asphalt Applied Systems: Heat bitumen in accordance with manufacturer's recommendations, but do not heat asphalt to a temperature greater than 100 degrees F above its equiviscous temperature (EVT).
 1. Maintain roofing equipment in good working order.
 2. Maintain bitumen within manufacturer and NRCA recommended EVT range at point of application.

3.5 CLEANING

- A. Remove bituminous markings from finished surfaces, including bitumen run-throughs into building.
- B. In areas where finished surfaces are soiled by bitumen or other source of soiling caused by roofing work, consult manufacturer of finished surfaces for recommended cleaning methods.
- C. Leave completed roof free from debris and uniform in appearance.

3.6 PROTECTION

- A. Where work must continue over finished roofing membrane, protect surface in accordance with manufacturer recommendations.

END OF SECTION

SECTION 07 53 10

ELASTOMERIC PVC MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide reinforced polyvinyl chloride (PVC) type elastomeric sheet membrane roofing system with base flashings, insulation, roof deck board, and accessories for complete, weather-tight installation.
- B. Related Sections:
 - 1. Section 06 10 50: Wood blocking and plywood in conjunction with roofing.
 - 2. Section 07 60 00: Flashing and sheet metal.

1.2 REFERENCE STANDARDS

- A. National Roofing Contractors Association: The NRCA Roofing and Waterproofing Manual.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Pre-Installation Meeting: Convene not less than one week prior to commencing work of this section. Require attendance of parties directly affecting roofing work.
 - 1. Review procedures and coordination required with related work.

1.4 SUBMITTALS

- A. Product Data: Submit membrane manufacturer's literature for membrane and base flashing materials; provide specific recommendations of insulation system manufacturer.
 - 1. Submit membrane manufacturer's recommendations for surface conditioning, flashing, joint cover and crack sealants, and temperature range for application of materials.
- B. Shop Drawings: Submit for PVC sheet seams and insulation layout; indicate location and insulation type; provide cross section indicating layers of insulation along with R-value calculations.
- C. Samples: Submit samples of each exposed material.
- D. Certifications:
 - 1. Installer: Submit certification installer is approved for roof system installation.
 - 2. Materials: Submit certification materials and components conform to Specifications and are compatible with each other, roof substrate, and related work.

3. Fire and Wind: Submit manufacturer's certification system conforms to fire and wind requirements.
4. Manufacturer Representative: Submit certification by manufacturer's representative indicating work has been installed in accordance with manufacturer's recommendations and installation instructions.

1.5 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to energy efficiency.
- B. Qualification of Installers: Company with minimum five years successful experienced in PVC membrane roof application on projects of similar scope.
 1. Installer: Roofing and insulation manufacturer certified or approved.
- C. Supervisor: Installer to maintain full-time supervisor/foreman who is on jobsite during roofing work who is experienced in installation of roofing system specified.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect foam insulation from direct sunlight exposure.

1.7 SITE CONDITIONS

- A. Do not apply roofing membrane during inclement weather or when air temperature may fall below 40 degrees F.
 1. Do not allow materials to be exposed to moisture during transportation, storage, handling or installation.
 2. Mark damp or wet materials, including felts which froth or foam during installation, and remove from site within 24 hours.
- B. Do not apply materials to damp, dirty, dusty, or otherwise unsuitable surfaces.
 1. Allow concrete surfaces to cure minimum 28 days.
- C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

1.8 WARRANTY

- A. Extended Correction Period: Provide for correcting failure of system to resist damage from anticipated sources including damage from wind and water penetration. Repair system and pay for or replace damaged materials and surfaces.
 1. Period: Two years.

- B. Manufacturer's Warranty: Submit manufacturer's warranty including special manufacturer services as required for manufacturer's warranty.
 - 1. Period: 20 years.
 - 2. Manufacturer's warranty shall not detract from requirements of extended correction period nor from Owner's rights under implied and expressed warranties regardless of wording of manufacturer's warranty.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Carlisle SynTec Systems.
- B. GenFlex Roofing Systems Div. GenCorp.
- C. Sarnafil Inc.
- D. HPG International Inc.
- E. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide reinforced polyvinyl chloride (PVC) type elastomeric sheet membrane roofing system with base flashings, and accessories.
 - 1. System: Fully adhered exposed membrane.
 - 2. Provide roofing system materials by a single manufacturer, except where materials of other manufacturers are specified or approved by Architect.
 - 3. Provide roof insulation, double layer application where indicated.
 - 4. Provide tapered insulation as required to ensure positive 1/4" per foot slopes to drains.
 - 5. Provide roof deck board to separate insulation from roof membrane.
- B. Regulatory Requirements
 - 1. Cool Roof System: Comply with California Building Standards Code requirements for "Cool Roof" system including three-year aged solar reflectance value requirements.
 - a. Label: System to have Cool Roof Rating Council (CRRC) label.
 - 2. Fire and Wind Resistance: Conform to California Building Standards Code requirements for Underwriters Laboratory (UL) Class A roof system, with UL Class 60 wind resistance classification.

- a. Provide materials conforming to code requirements for roof/ceiling 1-hour fire resistive rating for components and materials indicated in Contract Documents.
- C. Roof Membrane: ASTM D4434, Polyvinyl Chloride (PVC) Elastomeric membrane, reinforced, thickness as recommended by roof membrane manufacturer for application involved, but no less than 48 mils.
1. Scrim Reinforcing: Manufacturer's standard fleece, fiberglass, or polyester scrim.
 2. Corners and Elastomeric Membrane Flashing: Provide products using same base material as roof membrane; corners preformed.
 3. Seams: Solvent welded and seam sealant finished.
 4. UV Resistance: Provide materials with demonstrated resistance to ultraviolet light with no visible surface cracking or discoloration based on industry accepted accelerated test methods.
 5. Provide materials compounded specifically for application methods and substrates indicated on Drawings; comply with requirements for fire rated materials.
 6. Color: As indicated, as selected by Architect from manufacturer's full range of Cool Roof Rated colors where not indicated.
- D. Insulation: Provide materials approved for use with specified membrane and suitable for application indicated; provide tapered insulation where insulation is indicated to provide roof slopes.
1. Polyisocyanurate Insulation: ASTM C1289, Type II, Class 1, Grade 2 glass fiber faced isocyanurate, with ASTM C1303 Long Term Thermal Resistance (LTTR).
 2. Other Types of Insulation: Acceptable subject to manufacturer's recommendations, application involved, and total thickness required for specified thermal resistance.
 3. Thermal Resistance: Minimum total R-38.
- E. Roof Deck Board: ASTM C1278 with moisture and mold resistant core. Provide as indicated, as required for uniform surface for membrane adherence, and as required for fire and wind ratings.
1. Manufacturers:
 - a. Georgia Pacific/DensDeck Prime.
 - b. Johns Manville/Securock.
 - c. Substitutions: Refer to Section 01 25 00.
- F. Accessories: Provide as recommended by membrane manufacturer and system manufacturer as required for complete weather-tight installation, including, but not limited to:
1. Bonding adhesives, splicing cement, and lap sealants and mastics.

2. Seam plates.
 3. Molded pipe flashing.
 4. Temporary sealing, for end of day closing of membrane.
 5. Mechanical fasteners.
- G. Integral Coated Metal Flashings: Provide not less than 24-gage galvanized steel flashings, minimum G90 coating, coated with PVC materials for compatibility with direct bonding to roof membrane, as recommended by system manufacturer.
- H. Roof Protection Pads: Provide protection materials as recommended by membrane manufacturer where maintenance traffic is anticipated over membrane.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verify deck is dry, clean and smooth, free of depressions, waves and projections detrimental to roofing membrane, and properly sloped for drainage.
- B. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set and that cant strips, nailing strips, and reglets are in place.
- C. Beginning installation indicates acceptance of substrate.
- D. Metal Surfaces: Remove contaminants which may adversely affect adhesion or performance of roofing system; apply metal primer.

3.2 INSTALLATION

- A. Install membrane roofing system in accordance with manufacturer's recommendations and instructions and as required to meet requirements for warranty and applicable codes.
 1. Comply with NRCA Specification Guide for Thermoset Roof Membranes as applicable; where conflicts exist comply with manufacturer's recommendations.
- B. Insulation: Install insulation in accordance with insulation manufacturer's recommendations and roof membrane manufacturer's recommendations for installation indicated.
 1. Place insulation boards butted in close contact; stagger joints between insulation board layers.
 2. Bevel insulation to allow snug fit at penetrations; cut neatly around protrusions through roof.
- C. Roof Deck Board: Install in accordance with manufacturer recommendations and as required to ensure suitable substrate for membrane roofing over insulation, fire ratings, and wind ratings; secure to roofing deck.
 1. Place roof deck boards butted in close contact; stagger joints between roof deck board and insulation board joints.

2. Cut to allow snug fit at penetrations; cut neatly around protrusions through roof.
- D. Roof Membrane: Apply membrane in accordance with membrane manufacturer's recommendations and installation instruction. Provide heat welded seams.
1. Apply sheet membrane smooth, free from air pockets, wrinkles, fish-mouths, un-lapped joints, or tears, over first layer insulation.
 2. Extend roof membrane up vertical surfaces minimum 8" wherever possible and secure to nailing strips or reglets; reinforce corners with double applications of membrane.
 3. Install membrane flashings and seal into membrane.
 - a. Coordinate installation of roof drains and related flashings.
 4. Seal flashings and items projecting through membrane; seal terminations with additional layer of membrane and mastic.
 5. Prevent compounds from entering and clogging drains, and from spilling or migrating onto surface of other work.
- E. Roof Protection Pads: Secure roof protection pads in place in accordance with membrane manufacturer recommendations and as required to ensure protection of membrane from roof maintenance traffic.
1. Set pads to allow roof drainage; where pads cross drainage path set with not less than 4" and not more than 8" between pads.

3.3 FIELD QUALITY CONTROL

- A. Site Tests: Flood test roofing prior to installation of insulation and ballast; if defects are revealed, repair and repeat flood test until no defects are revealed.
1. Do not overload structure with flood test; if necessary, section off areas as necessary.
 2. Test for leaks with 2" depth of water maintained for 24 hours.
- B. Manufacturer's Field Services: Manufacturer's representative shall inspect work of Project on regular basis and provide certification roofing system has been installed in accordance with manufacturer's recommendations.
1. Provide unobstructed access to roofing work.
 2. Correct defects and irregularities as advised by manufacturer's representative.

3.4 CLEANING

- A. Remove roofing membrane markings from finished surfaces.

- B. In areas where finished surfaces are soiled by roofing work, consult manufacturer of finished surfaces for recommended cleaning methods.
- C. Leave completed roof free from debris and uniform in appearance.

3.5 PROTECTION

- A. Where work must continue over finished roofing membrane, protect surface in accordance with manufacturer recommendations.

END OF SECTION

SECTION 07 60 00

FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide metal flashings and sheet metal including accessories as required for complete weathertight installation.
 - 1. Flashing and sheet metal includes copings, fascias, scuppers, gutters, downspouts, rainwater leaders, reglets, and similar fabricated components as applicable to Project.
 - 2. Provide concealed sealants used in conjunction with installation of metal flashing and sheet metal.
 - 3. Provide miscellaneous sheet metal flashing and reglets not provided by other trades or suppliers.
 - a. Where reglets are to be installed in conjunction with other work, provide in adequate time for installation.
 - b. Where reglets are to be surface applied, provide continuous gasket between reglet and surface.
 - 4. Provide precast concrete splash blocks.
- B. Related Sections:
 - 1. Section 06 10 50: Miscellaneous rough carpentry.
 - 2. Section 07 28 00: Concealed flashing at weather barrier/underlayment.
 - 3. Section 08 91 00: Louvers.

1.2 REFERENCES

- A. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): Architectural Sheet Metal Manual.

1.3 SUBMITTALS

- A. Product Data: Furnish literature for manufactured products.
- B. Shop Drawings: Clearly indicate dimensioning, layout, general construction details including closures, flashings, locations and types of sealants, anchorages, and method of anchorage.
- C. Samples: Furnish samples of typical metal flashing fabrication indicating standard soldered joints and edge conditions.

1.4 QUALITY ASSURANCE

A. Sustainability Requirements:

- 1) two years' successful experience with CAL/Green requirements.
2. CALGreen Requirements: Refer to Section 01 35 15 – CALGreen Environmental Requirements and comply with applicable CALGreen Checklist indicating requirements applicable to Project.

1.5 DELIVERY, STORAGE AND HANDLING

- ### A. Provide strippable film protective covering on shop finished flashing materials to protect materials through shipping, fabrication and installation.

1.6 WARRANTY

- ### A. Extended Correction Period: Provide for correcting failure of system to resist damage from anticipated sources including damage from wind and water penetration. Repair system and pay for or replace damaged materials and surfaces.
1. Period: Two years.

PART 2 - PRODUCTS

2.1 MATERIALS

- ### A. System Description: Provide flashing and sheet metal including reglets and accessories as required for complete weathertight installation.
- ### B. Design Criteria: Allow for movement of components without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to 100-year seasonal temperature ranges.
- ### C. Flashing and Sheet Metal:
1. Galvanized Steel: ASTM A924 and A653 G90 galvanized steel; minimum 24-gage.
 - a. Mill phosphatized where indicated to be field painted.
 - b. Location (Concealed): Where indicated, if not otherwise indicated, provide where flashing will not be exposed to view from exterior of building and where not exposed to view from spaces within building.
 2. Copper Flashing: ASTM B370, cold rolled copper except where soft temper copper is required for forming; minimum 16-oz. (0.0216" thick).
 - a. Location (Exposed): Where indicated, if not otherwise indicated, provide where flashing will be exposed to view from exterior of building, and where exposed to view from spaces within building.

3. Shop Finished Galvanized Steel Flashing and Sheet Metal: ASTM A924 and A653 G90 galvanized steel; minimum 24-gage; with factory applied fluoropolymer coating based on Kynar 500 or Hylar 5000.
 - a. Manufacturers:
 - 1) Ryerson Building Products (800.328.7800)/ColorKlad.
 - 2) Metal Sales Manuf. Corp.(800.406.7387)/PVDF (Kynar 500).
 - 3) K&M Sheet Metal (888.567.7778)/Kynar Steel.
 - 4) Substitutions: Refer to Section 01 25 00.
 - b. Location (Exposed): Where indicated, if not otherwise indicated, provide where flashing will be exposed to view from exterior of building, and where exposed to view from spaces within building.
 - c. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
 - d. Touch-up Paint for Prefinished Sheet Metal: Type recommended by fluoropolymer manufacturer for field touch-up.
4. Stainless Steel Flashing and Sheet Metal: Stainless steel, ASTM A666, Type 304, soft annealed, 2B finish, minimum 26-gage.
 - a. Location (Exposed): Where indicated, if not otherwise indicated, provide where flashing will be exposed to view from exterior of building, and where exposed to view from spaces within building.
5. Aluminum and Zinc Alloy Coated Steel Flashing and Sheet Metal: Aluminum-zinc coated steel, ASTM A792, AZ55 coating; minimum 24 gage steel; coating to contain 55% aluminum, 43.5% zinc, and 1.5% silicon, or 55% aluminum and 45% zinc.
 - a. Trade Names: Galvalume and Zinalume.
 - b. Location (Exposed): Where indicated, if not otherwise indicated, provide where flashing will be exposed to view from exterior of building, and where exposed to view from spaces within building.
6. Zinc Alloy: Zinc/copper/titanium alloy conforming to DIN EN 988; not less than 0.025" thick.
 - a. Manufacturers:
 - 1) Rheinzink America, Inc./Rheinzink.
 - 2) VM Building Solutions/VM Quartz Zinc.
 - 3) Substitutions: Refer to Section 01 25 00.
 - b. Color: As selected by Architect from manufacturer's full range of colors including bright, bluegray, and graphite gray.
7. Mill Finished Aluminum: ASTM B209, 3003-H14, minimum thickness 0.040" unless otherwise indicated.

8. Anodized Aluminum Sheet: ASTM B209, 5005-H14, with minimum thickness of 0.050" unless otherwise indicated.
 - a. Clear Anodized Coating: AAMA 607.1 clear anodized, Architectural Class I 0.018mm or thicker coating.
 - b. Color Anodized Coating: AAMA 608.1, Architectural Class I 0.018mm or thicker coating; color as indicated on Drawings.
9. Extruded Aluminum: ASTM B221, alloy 6063-T52, with minimum thickness of primary legs 0.080" unless otherwise indicated; clear anodized unless otherwise indicated.
10. Prefinished High-Performance Coated Aluminum: Manufacturer's standard two coat thermocured fluoropolymer system containing not less than 70-percent polyvinylidene fluoride resin by weight; AAMA 2605 and AA-C12C42R1x.
 - a. Manufacturers:
 - 1) Ryerson Building Products (800.328.7800)/AlumaKlad.
 - 2) Merchant & Evans Industries, Inc.(800.257.6215)/Custom.
 - 3) Substitutions: Refer to Section 01 25 00.
 - b. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
 - c. Touch-up Paint for Prefinished Sheet Metal: Type recommended by fluoropolymer manufacturer for field touch-up.
11. Lead Flashing: ASTM B749, type L51121, copper-bearing sheet lead, minimum four pound per square foot (1/16" thick) lead with 6% to 7% antimony content.
12. Accessories: Provide strainers, outlet tubes, screens, baffles, hangers and gutter ends as required for a complete system and complying with SMACNA Manual.
13. Provide heavier gage metal where recommended by SMACNA Manual for size of component.
- D. Manufactured Reglets: Snap-on type, for two-piece flashing; metal to match flashing and sheet metal.
 1. Manufacturers:
 - a. Fry Reglet Corp./Springlok System.
 - b. W.P. Hickman Co./The Leading-Edge Drive Lock System.
 - c. Substitutions: Refer to Section 01 25 00.
- E. Rain Chains: Galvanized steel linked chain with links consisting of nominal 1/4" wire formed into nominal 1-1/4" welded links; chain size as required to allow secure installation with chain fixed at gutter and as indicated at grade.
- F. Solder and Fasteners: As recommended by SMACNA and complying with applicable codes and regulations; hot dipped galvanized minimum coating comparable to G90.

- G. Concealed Sealant: Butyl type for use in conjunction with sheet metal; non-staining; non-corrosive; non-shrinking and non-sagging; ultra-violet and ozone resistant for exterior concealed applications.
- H. Bituminous Paint: Acid and alkali resistant type; black color; asbestos free.
- I. Plastic Cement: Cutback asphaltic type; asbestos free.
- J. Sealing Compound: Type recommended by roofing manufacturer; asbestos free.
- K. Gaskets: Type suitable for use in conjunction with sheet metal; non-staining, non-corrosive, non-shrinking, non-sagging, ultra-violet resistant, and ozone resistant; for exterior concealed applications.
 - 1. Manufacturers:
 - a. Emseal USA, Inc./Emseal MST Multi-Use Sealant Tape.
 - b. Substitutions: Refer to Section 01 25 00.
- L. Splash Blocks: Precast concrete of size and profile as approved by Architect; minimum 2000 psi at 28 days with minimum 5% air entrainment.

2.2 FABRICATION

- A. Fabricate sheet metal in accordance with SMACNA Architectural Sheet Metal Manual.
- B. Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
 - 1. Fabricate corners and intersections in shop with solder joints; watertight fabrication.
- C. Form sections in maximum 10'-0" lengths; make allowance for expansion at joints.
- D. Hem exposed edges on underside 1/2".
- E. Back-paint flashings with heavy bodied bituminous paint where in contact with cementitious materials or dissimilar metals.
- F. Form pitch pans watertight, with minimum 4" upstand and 4" flanges; form pans minimum 6" wider than item passing through roof membrane.
- G. Form umbrella flashings with minimum 2" overhang, to shed water away from pitch pans.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install metal flashing and sheet metal in accordance with SMACNA Architectural Sheet Metal Manual.

1. Install tight in place, with corners square, surfaces true and straight in planes, and lines accurate to profiles as indicated on Drawings.
 2. Lap joints in direction of water flow.
 3. Hold downspouts in position, clear of wall, by hangers spaced not more than 10'-0" on center; securely fasten hangers to wall without exposed damage to wall surface.
- B. Exercise care when cutting materials on site, to ensure cuttings do not remain on finished surfaces.
- C. Provide expansion joints concealed within system.
- D. Use concealed fasteners, continuous cleat type, except where specifically approved by Architect.
1. Exposed fasteners may be used, where clearly indicated on shop drawings and approved by Architect, at areas not exposed at exterior walls nor in sight of interior spaces.
- E. Apply sealing compound at junction of metal flashing and felt flashing.
- F. Lock seams and end joints; fit flashing tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- G. Counter-flash mechanical and electrical items projecting through roof membrane.
- H. Install sealants where required to prevent direct weather penetration.
1. Install continuous gasket behind surface applied reglets.
- I. Completed installation shall be free of rattles, noise due to thermal and air movement, and wind whistles.
- J. Install pitch pans and fill with plastic cement.
- K. Install umbrella flashing with draw band collars with sheet metal sealant between penetrating item and flashing; use wood blocking at angle type penetrations and cover blocking with sealant.
- L. Install splash blocks at locations to interrupt fall of water and direct water flow as indicated on Drawings.
- 3.2 CLEANING
- A. Remove protective coating from shop finished sheet metal when no longer required to protect roofing and flashing from construction.
- B. Touch-up scratched and damaged finish to match new; remove and replace sheet metal units that cannot be repaired to look identical to adjacent sheet metal when viewed from 15'-0" away.

END OF SECTION

SECTION 07 90 00

JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide joint sealants, for interior and exterior joints not specified elsewhere, with backing rods and accessories as required for complete installation.
 - 1. Joint sealants include joint sealers and calking as indicated.
- B. Related Sections:
 - 1. Section 07 60 00: Flashing and sheet metal concealed sealants.
 - 2. Section 08 80 00: Glazing sealants.
 - 3. Section 09 21 00: Sealants used for acoustical treatment at gypsum board.

1.2 SUBMITTALS

- A. Product Data: Furnish manufacturer's descriptive literature.
- B. Samples: Furnish samples of each type of exposed joint sealer in required colors.
- C. Certifications:
 - 1. Furnish manufacturer's certification joint sealers comply with Contract Documents and are suitable for Project applications.
 - 2. Furnish certification indicating installers are trained in proper use of specified products, qualified, and familiar with proper installation techniques.

1.3 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control for adhesives, sealants, and caulks.
 - 1. Provide joint sealants as required by applicable codes and regulations to fill joints and openings in building envelope separating conditioned space from unconditioned space.
- B. Installer Qualifications: Firm with minimum five years successful experience on projects of similar type and size, using specified products.
- C. Installers shall be familiar with proper application procedures to ensure maximum joint sealer expansion and contraction capabilities.
- D. Mock-Up: Provide exterior joint sealers where required for mock-ups of other systems.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, cure time, and mixing instructions.

1.5 SITE CONDITIONS

- A. Do not proceed with installation of joint sealers under unfavorable weather conditions.
- B. Install elastomeric sealants when temperature is in lower third of temperature range recommended by manufacturer.

1.6 WARRANTY

- A. Extended Correction Period: Extend correction period to two years.
 - 1. Repair or replace joint sealers which fail to perform as intended, because of leaking, crumbling, hardening, shrinkage, bleeding, sagging, staining, loss of adhesion, and loss of cohesion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. System Description: Provide joint sealants with backing rods and accessories.
- B. Performance Requirements:
 - 1. Select materials for compatibility with joint surfaces and indicated exposures.
 - 2. Where not indicated, select modulus of elasticity and hardness or grade recommended by manufacturer for each application indicated.
 - 3. Comply with applicable limitations on volatile organic compound (VOC) emissions.
- C. Regulatory Requirements: Comply with applicable regulatory requirements regarding limitations on volatile organic compound (VOC) emissions limitations.
- D. Elastomeric Sealants:
 - 1. Single Component Low Modulus Silicone Sealant: ASTM C920 Type S, Class 25, Grade NS; minimum 50% expansion and compaction capability.
 - a. Provide at exterior locations not exposed to traffic.
 - b. Manufacturers:
 - 1) GE (Momentive Performance Materials)/Silpruf, Silglaz or GESIL.
 - 2) Dow Corning Corp./790 or 795.
 - 3) Pecora Corp./864 Architectural Silicone.
 - 4) Tremco/Spectrem 3.
 - 5) Substitutions: Refer to Section 01 25 00.

2. Multi-Component Polyurethane Sealant: ASTM C920, Type M, Grade NS, Class 25, non-sag; minimum 25% expansion and compaction capability.
 - a. Provide at exterior locations not exposed to traffic.
 - b. Manufacturers:
 - 1) Pecora Corp./Dynatrol II.
 - 2) Tremco/Dymeric 240.
 - 3) BASF/MasterSEal NP 2.
 - 4) Substitutions: Refer to Section 01 25 00.
3. Single Component Low Modulus Sealant: ASTM C920 Type S, Class 35, Grade NS; minimum 50% expansion and compaction capability.
 - a. Provide at exterior locations not exposed to traffic.
 - b. Manufacturers:
 - 1) Fortifiber Building Systems Group/Moistop Sealant.
 - 2) Sika Group/SikaFlex 1A+.
 - 3) Substitutions: Refer to Section 01 25 00.
4. Multi-Component Polyurethane Sealant: ASTM C920, Type M, Grade P, Class 25, self-leveling; minimum 25% expansion and compaction capability.
 - a. Provide at traffic bearing locations.
 - b. Manufacturers:
 - 1) Pecora Corp./Urexpan NR-200, or Dynatrol II-SG.
 - 2) Tremco/THC 900-901, or Vulkem 445 SSL.
 - 3) BASF/MasterSeal SL 2
 - 4) Substitutions: Refer to Section 01 25 00.
5. Mildew-Resistant Silicone Rubber Sealant: ASTM C920, Type S, Grade NS, Class 25, compounded with fungicide, specifically for mildew resistance and recommended for interior joints in wet areas.
 - a. Provide at interior joints in wet areas.
 - b. Manufacturers:
 - 1) GE (Momentive Performance Materials)/SCS 1702 Sanitary Sealant.
 - 2) Dow Corning Corp./786 Bathtub Caulk.
 - 3) Pecora Corp./898 Sanitary Mildew Resistant Sealant.
 - 4) Tremco/Tremsil 200.
 - 5) Substitutions: Refer to Section 01 25 00.

E. Non-Elastomeric Sealants:

1. Acrylic-Emulsion Sealant: ASTM C834 acrylic or latex-rubber-modified acrylic sealant, permanently flexible, non-staining and non-bleeding; recommended for general interior exposure; compatible with paints specified in Section 09 90 00.
 - a. Provide at general interior applications.
 - b. Manufacturers:
 - 1) Pecora Corp./AC-20.
 - 2) Tremco/Tremflex 834.
 - 3) Substitutions: Refer to Section 01 25 00.
2. Air Seals: Provide non-staining and non-bleeding sealers, calks, or foams appropriate to specific applications for filling openings between conditioned and unconditioned spaces.
 - a. Type: As recommended by manufacturer for each specific application; compatible with adjacent materials.
 - b. Manufacturers:
 - 1) Dow/Great Stuff.
 - 2) Owens Corning/EnergyComplete Air Sealant.
 - 3) Hilti/Foam Filler CF 812.
 - 4) Substitutions: Refer to Section 01 25 00.
 - c. Pest Control Mesh: Openings subject to pest infiltration to have 304 stainless steel wool, material stuffed in joint before application of air seals using methods to ensure blocking of gap from pests.
 - d. Exception: Annular spaces around pipes, electric cables, conduits and other openings in exterior walls shall be protected against passage of rodents by closing with cementitious grout.
 - 1) Cementitious Grout: ASTM C1107 non-shrink, non-metallic, pre-mixed, factory-packaged, non-staining, non-corrosive; type specifically recommended by manufacturer as applicable to job condition.

F. Miscellaneous Materials:

1. Primers/Sealers: Non-staining types recommended by joint sealer manufacturer for joint surfaces to be primed or sealed.
2. Joint Cleaners: Non-corrosive types recommended by joint sealer manufacturer; compatible with joint forming materials.
3. Bond Breaker Tape: Polyethylene tape as recommended by joint sealer manufacturer where bond to substrate or joint filler must be avoided for proper performance of joint sealer.

4. Sealant Backer Rod: Compressible polyethylene foam rod or other flexible, permanent, durable non-absorptive material as recommended by joint sealer manufacturer for compatibility with joint sealer.
 - a. Oversize backer rod minimum 30% to 50% of joint opening.
- G. Colors: As indicated, as selected by Architect from manufacturer's full range of colors where not indicated.
 1. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare joint surfaces in accordance with ASTM C1193 and as recommended by joint sealer manufacturer.
- B. Clean joint surfaces immediately before installation of joint sealer; remove dirt, insecure materials, moisture and other substances which could interfere with bond of joint sealer.
- C. Prime or seal joint surfaces where recommended by joint sealer manufacturer; do not allow primer/sealer to spill or migrate onto adjoining surfaces.
- D. Ensure protective coatings on surfaces in contact with joint sealers have been completely stripped.

3.2 INSTALLATION

- A. Comply with manufacturer's printed instructions and ASTM C1193, except where more stringent requirements are shown or specified.
- B. Pest Control: Install stainless steel wool prior to application of backer rods and bond breakers at air seal and as required to ensure complete pest blockage at joints where pest intrusion is a potential.
- C. Set sealant backer rods at proper depth or position in joint to coordinate with other work, including installation of bond breakers and sealant; do not leave voids or gaps between ends of backer rods.
 1. Do not stretch, twist, puncture or tear backer rods.
- D. Install bond breaker tape as required to avoid three-sided bond of sealant to substrate and where required by manufacturer's recommendations to ensure joint sealers will perform properly.
- E. Size materials to achieve required width/depth ratios.
- F. Employ installation techniques that will ensure joint sealers are deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of bond surfaces equally on opposite sides.

- G. Joint Configuration: Fill sealant joint to a slightly concave surface, slightly below adjoining surfaces, unless otherwise indicated.
- H. Where horizontal joints are between a horizontal surface and vertical surface, fill joint to form a slight cove, so that joint will not trap moisture or dirt.
- I. Install joint sealers to depths recommended by joint sealer manufacturer but within the following general limitations, measured at center (thin) section of bead.
 - 1. Horizontal Joints: 75% width with minimum depth of 3/8".
 - 2. Elastomeric Joints: 50% width with minimum depth of 1/4".
 - 3. Non-Elastomeric Joints: 75% to 125% of joint width.
- J. Spillage: Do not allow sealants or compounds to overflow or spill onto adjoining surfaces, or to migrate into voids of adjoining surfaces.
 - 1. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage.
- K. Cure joint sealers in compliance with manufacturer's instructions and recommendations to obtain high early bond strength, internal cohesive strength and surface durability.
- L. Maintain finished joints free of embedded matter, ridges and sags.

END OF SECTION

SECTION 08 11 10

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide full flush steel (hollow metal) doors and pressed steel frames, including anchors and silencers.

1. Pressed steel frames include both door and window framing.

- B. Related Sections:

1. Section 08 71 00: Door hardware.
2. Section 08 80 00: Glazing.

1.2 REFERENCES

- A. Steel Door Institute (SDI): SDI-100 (ANSI/SDI A250.8) - Recommended Specifications - Standard Steel Doors and Frames.
- B. National Association of Architectural Metal Manuf. (NAAMM): Hollow Metal Manual.
- C. Underwriters Laboratories: Standards as applicable to fire rated doors and frames.
1. Materials tested, labeled and inspected by Warnock Hersey International are acceptable upon approval of authorities.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:

1. Coordinate hardware installation with Section 08 71 00 – Door Hardware.
2. Coordinate glass installation with Section 08 80 00 - Glazing.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturers' literature.
- B. Shop Drawings: Indicate general construction, configuration, jointing methods, reinforcement, anchorage methods, hardware locations, and locations of cut-outs.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Amweld Building Products Inc.

- B. Ceco Door Division Assa Abloy Door Group.
- C. Curries Division Assa Abloy Door Group.
- D. Door Components, Inc.
- E. Republic Doors and Frames.
- F. Krieger Steel Products Co.
- G. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide full flush steel (hollow metal) doors and pressed steel frames, including anchors and silencers.
- B. Doors: Hollow metal flush steel door, 1-3/4" thick.
 - 1. Typical: Full flush with steel channel or welded edge; close top with flush end closer treatment, bottom optional flush or recessed channel; steel stiffened core, insulated at exterior doors; continuous welded seam.
 - 2. Interior Doors: Minimum 0.042" (18-gage).
 - 3. Exterior Doors: Minimum 0.053" (16-gage).
 - 4. Glazed and Louver Doors: Provide systems as indicated on Drawings.
- C. Frames:
 - 1. Exterior Frames: Welded (pre-assembled) type.
 - 2. Interior Frames: Knockdown (field-assembled) type; provide 3/8" back bend return on frames at gypsum board.
 - 3. Gage: Minimum 0.053" (16-gage) interior frames, 0.067" (14-gage) exterior frames.
 - 4. Door Silencers: Manufacturer's standard resilient type; removable for replacement.
 - 5. Mortar Guard Boxes: Minimum 0.026" (22-gage) mortar guard boxes welded in place; provide where frames may be grouted.
- D. Glazing Stops: Full flush type with glass centered in opening, unsecured side integral with unit, secured side fastened with flush, countersunk Allen type fasteners; minimum 0.053" (16-gage).

- E. Fire Rated Units: Construct in accordance with requirements for fire rating, NFPA 252 or UL 10C, and NFPA 80.
 - 1. Labels: Place fire rating labels where visible when doors and frames are in installed, opened position.
 - 2. Fire Ratings: Refer to Drawings for fire rating requirements.
 - 3. Temperature Rise Rating: Provide doors with maximum 450°F Temperature Rise Rating in 30-minute fire exposure period at doors into exit enclosures and where otherwise required by applicable codes.
- F. Door Louvers:
 - 1. Interior Doors: Stationary, sight-proof hood or Y type blades of 24-gage steel inserted into door panels full door thickness; no exposed trim.
 - 2. Exterior Doors: Weatherproof Z-shaped blades with U-shaped frames; 1-3/8" thick; blades 1-1/2" on center; 0.053" (16 gage) welded construction.
 - a. Provide removable bird screens on interior faces, 1/2" by 1/2" bronze wire mesh.

2.3 FABRICATION

- A. Conform to requirements of SDI (ANSI A250 Series) or NAAMM.
- B. Reinforce and prepare doors and frames to receive hardware.
 - 1. Refer to Section 08 71 00 for hardware requirements.
- C. Frames:
 - 1. Welded Frames: Accurately form and cut mitered corners of welded type frames; continuously weld on inside surfaces (fully welded); grind welded joints to smooth uniform finish.
 - 2. Knocked Down Frames: Accurately form and miter interlocking joints of knocked down frames to maintain hairline alignment of parts when field assembled.
 - 3. Head Reinforcement: Reinforce frames wider than 4'-0" with minimum 0.093" (12 gage) formed steel channels welded in place, flush with top of frames.
 - 4. Doors at Glazed Panels: Reinforce jambs and heads of frames for doors which occur adjacent to glazed sidelights and partitions.
- D. Door Silencers:
 - 1. Place three single bumpers on single door frames; space equally along strike jambs.
 - 2. Place two single bumpers on double door frames; place on frame heads.

3. Place three single bumpers for each door on door frames with removable mullions, spaced equally along strike jambs, and in addition place two single bumpers on frame heads to cushion door when mullion is removed.
- E. Provide jamb anchors per SDI-100 (ANSI/SDI 250.8) and NAAMM; weld floor jamb anchors in place.
- F. Provide double doors tested and approved without astragals.
 1. Provide astragals for double doors when required to meet UL requirements for Class A, 3-hour rated doors only.
- G. Edge Clearances:
 1. Between Doors and Frames: Maximum 1/8" at head and jambs.
 2. Door Sills (No Threshold): Maximum 1/2".
 3. Door Sills (Threshold): Maximum 3/8" above finished floor.
 4. Between Edges of Pairs of Doors: Maximum 1/8".
 5. Fire Rated Doors: As required for fire ratings.
- H. Finish: Comply with requirements of Section 09 90 00 – Painting and Coating for primer including application and compatibility with specified finishes.
 1. Interior Units: Prime paint.
 2. Exterior Exposed Units: Apply minimum A60 non-spangle galvanized coating, ASTM A924 and A653.
 - a. Surface treat after galvanizing to remove oils and prepare for painting and apply one coat of primer; comply with requirements in Section 09 90 00.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install doors and frames in accordance with SDI-100 (ANSI/SDI A250.8) and ANSI/SDI A250.11 or NAAMM "Hollow Metal Manual" and with manufacturer's recommendations and installation instructions.
 1. Install fire rated units in conformance with fire label requirements and NFPA 80.
- B. Install doors and frames plumb and square within 1/16", and with maximum diagonal distortion of 1/32".
- C. Remove and replace doors and frames damaged during delivery, storage, installation and construction.
 1. Paste filler repair shall not be permitted.
- D. After installation, touch-up scratched paint surfaces.

END OF SECTION

SECTION 08 14 00

WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide flush wood doors as indicated.
 - 1. Contractor Option: Provide shop finished wood doors.
- B. Related Work
 - 1. Section 06 20 00: Wood door frames.
 - 2. Section 08 11 10: Pressed steel frames.
 - 3. Section 08 71 00: Door hardware.
 - 4. Section 08 80 00: Glass and glazing for wood doors.

1.2 REFERENCES

- A. North American Architectural Woodwork Standards – 3.1, (NAAWS).
- B. Window and Door Manufacturer's Association (WDMA): Guide Specifications.
- C. Underwriters Laboratories Inc. (UL): Building Materials Directory.
 - 1. Materials tested, labeled and inspected by Warnock Hersey International are acceptable upon approval of authorities.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Wood Jambs: Coordinate with Section 06 20 00 – Finish Carpentry for prefit wood doors for door jambs.
 - 2. Hardware: Coordinate hardware installation with Section 08 71 00 – Door Hardware.
 - 3. Glazing: Coordinate glazing with Section 08 80 00 – Glazing.
 - 4. Painting: Coordinate with Section 09 90 00 – Painting and Coating whether wood doors are to be shop finished or field painted.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's literature.
- B. Shop Drawings: Indicate general construction, jointing methods, hardware locations, and locations of cut-outs.

- C. Samples: Submit samples of wood doors indicating construction, veneering, and finish.
 - 1. Submit shop finish for wood doors where doors are furnished shop finished.
- D. Certificates: Submit manufacturer certification indicating compliance to applicable requirements of either NAAWS or WDMA Standards; note which standards were followed or if both standards have been met.
 - 1. Wood Product Certification: Furnish certification indicating wood products are from FSC "well-managed" forests.

1.5 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control for composite wood products formaldehyde limitations and paints and coatings.
- B. Certified Wood Products: Wood products to be from forests certified "well-managed" by an agency accredited by Forest Stewardship Council (FSC).

1.6 SITE CONDITIONS

- A. Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized in accordance with referenced standards requirements applicable to Project location.

1.7 WARRANTY

- A. Extended Correction Period: Provide for replacing, rehangng, and refinishing wood doors exhibiting defects in materials or workmanship including warp and delamination.
 - 1. Period: Two years.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Algoma Hardwoods, Inc.
- B. Eggers Industries Architectural Door Division.
- C. Marshfield Door Systems, Inc.
- D. VT Industries.
- E. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide flush wood doors as indicated.

- B. Solid Core Flush Wood Doors: NAAWS/Premium Grade, 5 Ply Hot Press, 1-3/4" thick solid wood framed glued block construction or particleboard core five ply construction; Contractor option to use WDMA comparable standards.
1. Transparent/Stained Wood Veneers: NAAWS/Premium Grade veneers for transparent/stained finish; nominal 1/40" thick before sanding, not less than 1/50" after sanding.
 - a. Wood Veneers: Types as indicated, as directed by Architect where not otherwise indicated.
 2. Opaque Painted Wood Veneers: NAAWS/Custom Grade White Birch veneers for opaque finish; nominal 1/40" thick before sanding, not less than 1/50" after sanding.
 3. Edges: Stile edges to match face veneer, minimum 1-1/8" thick after trim.
 4. Core: Bond stiles and rails to core and sand prior to assembly of face veneers.
 5. Bond Type: Provide Type I Bond for exterior doors, Type II Bond for interior doors.
 6. Bond Type: Provide Type II Bond for interior doors.
 7. Fire Rated Flush Wood Doors: 1-3/4" thick, match non-rated door appearance; comply with applicable codes; UL or Warnock Hersey rated.
 - a. Labels: Place fire rating labels where visible when doors are installed, in opened position.
 - b. Fire Ratings: Refer to Drawings for fire rating requirements.
 - c. Core: Use wood core construction for 20 minute rated flush doors, mineral core permitted for longer ratings.
 - d. Temperature Rise Rating: Provide doors with maximum 450°F Temperature Rise Rating in 30-minute fire exposure period at doors into exit enclosures, for horizontal exits, and as required by applicable codes.
- C. Hollow Core Flush Wood Doors: NAAWS/Custom Grade, 5 Ply Hot Press, 1-3/8" thick standard hollow core five-ply construction; Contractor option to use WDMA comparable standards.
1. Transparent/Stained Wood Veneers: NAAWS/Premium Grade veneers for transparent/stained finish; nominal 1/40" thick before sanding, not less than 1/50" after sanding.
 - a. Wood Veneers: Types as indicated, as directed by Architect where not otherwise indicated.
 2. Opaque Painted Wood Veneers: NAAWS/Custom Grade White Birch veneers for opaque finish; nominal 1/40" thick before sanding, not less than 1/50" after sanding.

3. Edges: Stile edges to match face veneer, minimum 1-1/8" thick after trim.
4. Bond Type: Type II Bond, interior.

2.3 FABRICATION

- A. Fabricate doors in accordance with requirements of specified standards.
 1. Prefit wood doors.
 2. Prepare doors to receive hardware in shop, refer to Section 08 71 00 for hardware requirements and templates.
 3. Factory machine doors for mortise hardware.
- B. Bevel strike edge of single-acting doors, 1/8" in 2".
 1. Radius strike edge of double-acting swing doors 2-1/8".
- C. Fire Rated Doors: Fabricate fire rated doors in accordance with requirements of Underwriters' Laboratories (UL) or Warnock Hersey International.
 1. Provide fire rated doors with maximum allowable edge strips, of wood species to match face veneers.
 2. Provide doors with blocking designed for addition of closers, even where doors are not indicated to receive closers.
 3. Provide astragals and metal edge trim for double doors, in accordance with requirements for fire rated doors.
- D. Make cut-outs and provide matching wood stops for glass; profiles as indicated, type as selected by Architect where not otherwise indicated.
 1. Fire Rated Doors: Provide minimum 18-gage metal stops conforming to fire rating requirements.
- E. Shop Finished Doors (Contractor Option): Conform to requirements specified in Section 09 90 00 – Painting and Coating.
 1. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wood doors in accordance with manufacturer's recommendations and installation instructions, and reference standards, plumb and square, and with maximum diagonal distortion of 1/16".
 1. Install fire rated wood doors in accordance with requirements for specified fire label and requirements of NFPA 80.

- a. Field cutting of fire rated doors shall not be acceptable.
- B. Rehang or replace doors which do not swing or operate freely.

3.2 PROTECTION

- A. Protection: Protect doors as recommended by door manufacturer to ensure doors are without damage at time of Substantial Completion.
 - 1. Shop Finished Doors: Refinish or replace damaged doors.

END OF SECTION

SECTION 08 31 00

ACCESS DOORS AND PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide access doors set in finished surfaces.
 - 1. Provide access doors and panels as required for access to controls and valves behind finished surfaces.
 - 2. Coordinate with various trades for controls and valves which may be concealed.

1.2 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature.
- B. Shop Drawings: Indicate locations of access doors required but not indicated on Architectural Drawings.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Milcor Inc.
- B. Karp Associates, Inc.
- C. J.L. Industries.
- D. Nystrom Building Products.
- E. Elmdor Manufacturing Co.
- F. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide access doors and panels set in finished surfaces.
- B. Regulatory Requirements: Where doors and panels are in fire rated assemblies provide assemblies listed in Underwriters Laboratories, Inc. "Classified Building Materials Index" for rating shown.
 - 1. Provide UL label on each rated access door.
 - 2. Materials tested, labeled and inspected by Warnock Hersey International are acceptable upon approval of authorities.

- C. Access Doors and Panels: Provide access door and panel assemblies consisting of an integral unit with flush metal doors and panels, complete and ready for installation.
 - 1. Fire Rated Units: Match Milcor/Model UFR Universal flush panel fire rated doors.
 - 2. Wall Units: Match Milcor/Style M flush panel style; prime painted unless otherwise indicated.
 - 3. Units Mounted in Plaster: Match Milcor/Style K, flush panel style.
 - 4. Units Mounted in Adhered Acoustical Tile Ceilings: Match Milcor/Style AT recessed panel style to receive acoustical tile.
 - 5. Gypsum Board Ceilings: Match Milcor/Style ATR recessed panel style to receive gypsum board insert with edges filled and taped.
 - 6. Floor Doors: Match Milcor/Style FA flush steel plate.
- D. Frames: Fabricate from not less than 16-gage steel.
- E. Doors: Flush panel type, fabricate from not less than 14-gage steel.
- F. Hinges: Provide continuous piano type hinge.
- G. Locking Devices: Provide flush, key-operated cylinder lock for each access door; provide two keys per lock and key locks alike, unless otherwise scheduled.
- H. Finish: Finish with manufacturer's factory-applied enamel prime coat applied over phosphate coating on steel.
 - 1. Stainless Steel: Where indicated provide Type 304 corrosion resistant nonmagnetic stainless-steel access doors and frames.

2.3 FABRICATION

- A. Size Variations: Obtain Architect's acceptance of manufacturer's standard size units which may vary slightly from sizes shown or scheduled.
- B. Fabricate units of continuous welded steel construction; grind welds smooth and flush with adjacent surfaces.
- C. Provide attachment devices and fasteners of type required for specific job conditions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which access doors are to be installed.
 - 1. Do not proceed with work until unsatisfactory conditions are corrected; installation signifies acceptance of conditions.

- B. Obtain specific locations and sizes for required access doors from trades requiring access to concealed equipment; coordinate installation with work of other trades.

3.2 INSTALLATION

- A. Comply with manufacturer's installation instructions for access doors.
 - 1. Install fire rated access doors in accordance applicable code requirements and with requirements of NFPA 80.
- B. Set frames accurately in position and securely attach to supports with face panels plumb or level in relation to adjacent finish surfaces.
- C. Adjust hardware and doors after installation for proper operation.

3.3 PROTECTION

- A. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 08 41 00

ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide aluminum-framed entrances and storefront systems, with stock non-automatic doors, hardware, anchorage, glazing, and accessories as required for complete installation.
- B. Related Sections:
 - 1. Section 07 90 00: Perimeter sealants and back-up materials.
 - 2. Section 08 71 00: Cylinders for door locks

1.2 REFERENCES

- A. American Architectural Metal Manufacturers (AAMA): Aluminum Store Front and Entrance Manual.
- B. Glass Association of North America (GANA): Glazing Manual.
- C. National Association of Architectural Metal Manuf. (NAAMM): Metal Finishes Manual.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Design/Build: Provide special engineering for entrances and storefronts to ensure they comply with applicable codes and Contract Documents.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's literature.
- B. Shop Drawings: Indicate pertinent dimensioning, general construction, component connections and locations, anchor methods and locations, hardware locations, and relevant details.
- C. Samples: Furnish samples of metal finish, glass and glazing gasket.
- D. Design/Build Certificates: Submit certification signed by California licensed structural engineer indicating compliance with Contract Documents and code requirements.

1.5 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to energy efficiency.
- B. Installer Qualifications: Manufacturer or firm with minimum five years successful experience in the installation of systems similar to type and size required for Project and approved by manufacturer.

1.6 WARRANTY

- A. Extended Correction Period: Provide for correcting failures including wind damage and water penetration to interior surfaces, excessive deflections, and deterioration of finishes, weather-stripping and accessories.

- 1. Period: Two years.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Kawneer, an Arconic Company.
- B. Oldcastle Building Envelope.
- C. Arcadia, Inc.
- D. EFCO Corporation.
- E. TRACO.
- F. C.R. Laurence, United States Aluminum Div.
- G. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide aluminum-framed entrances and storefront systems, with stock non-automatic doors, hardware, anchorage, glazing, and accessories.
- B. Regulatory Requirements, General: Comply with requirements of applicable codes.
 - 1. Safety Glass Standard: Comply with applicable codes and CPSC 16 CFR 1201 and pass ANSI Z97.1.
- C. Regulatory Requirements, California Energy Code: Comply with California Energy Commission requirements regarding energy performance of aluminum framed storefronts.
 - 1. Manufacturer shall be responsible for providing information required by authorities necessary to verify conformance.
 - 2. Entire assembly, including glass and glazing, shall be certified by the National Fenestration Rating Council (NFRC) and shall bear NFRC Label indicating energy performance technical information.
- D. Regulatory Requirements, Accessibility: Comply with requirements of California Building Code and Americans with Disabilities Act (ADA) Standards to ensure access to persons with disabilities.

- E. Design Criteria: Comply with recommendations of AAMA Aluminum Store Front and Entrance Manual except where more stringent requirements are specified.
 - 1. Deflection: Maximum L/175, ASTM E330.
 - a. Safety Factor: Design for specified pressures with no glass breakage, no permanent damage to fasteners, and no permanent deformation of framing in excess of 0.2% of member clear span.
 - 2. Water Penetration: No uncontrolled water penetration, ASTM E331, with no water on exposed interior components; static pressure differential of 20% of inward wind load, with minimum 6-psf load.
 - 3. Air Leakage: Maximum 0.06 cfm/sf, ASTM E283, at differential static pressure of 6.24-psf at fixed glazing and not more than 0.3 cfm/sf at doors.
- F. Performance Criteria: Design assemblies capable of withstanding minimum uniform test pressures as required by applicable codes when tested in accordance with ASTM E330.
- G. Aluminum-Framed Entrance and Storefront Systems: Systems with profiles as indicated on Drawings; provide extruded aluminum security type glass stops of profile to suit frame design.
 - 1. Aluminum Type: As recommended by manufacturer for application indicated, but not less than extruded aluminum, ASTM B221, 6061 or 6063 alloy and T5 or T6 temper.
 - 2. Finish, High Performance Organic Coating: AA-C12C42R1x, prepared, pretreated, and coated with minimum two coat Kynar 500 or Hylar 5000 system; AAMA 2605.
 - a. Color: As indicated, as selected by Architect from manufacturer's full line of colors (non-metallic), where not indicated.
 - 3. Finish, High Performance Organic Coating: AA-C12C42R1x, prepared, pretreated, and coated with minimum two coat system; AAMA 2605.
 - a. PVDF Manufacturers:
 - 1) Arkema Group/Kynar 500.
 - 2) Solvay/Hylar 5000.
 - 3) Substitutions: Refer to Section 01 25 00.
 - b. Paint Manufacturers:
 - 1) PPG Industries.
 - 2) Valspar Corp.
 - 3) Akzo Nobel.
 - 4) Substitutions: Refer to Section 01 25 00.
 - 4. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.

5. Finish, Clear Anodized: Clear anodized coating conforming with NAAMM Metal Finishes Manual, Architectural Class I, 0.7 mil or greater.
 6. Finish, Color Anodized: Color anodized coating conforming with NAAMM Metal Finishes Manual, Architectural Class I, 0.7 mil or greater.
 - a. Color: As indicated, as directed by Architect where not otherwise indicated.
 - b. Architect reserves right to reject units of color or texture variations which are visually objectionable, but only where variation exceeds range established by manufacturer prior to work.
- H. Doors, Frames, and Hardware: Barrier-free entry doors meeting code requirements for providing access for people with physical disabilities; by entrance manufacturer.
1. Type: Medium stile, nominal 3-1/2" wide stiles and head rail with 10" bottom rail.
 2. Metal and Finish: Match entrance system.
 3. Hardware: Provide complete hardware system except as indicated; match window wall system finish unless otherwise directed by Architect. Coordinate with Section 08 71 00 – Door Hardware.
 - a. Pivots/Closers: Center-hung pivots with concealed adjustable type closer, maximum 5-pound operating pressure when installed in final application.
 - b. Hinges: Extra heavy-duty ball bearing full mortise (butt) hinges complying with requirements specified in Section 08 71 00.
 - c. Closers: Concealed adjustable type closer, maximum 5-pound operating pressure when installed in final application.
 - d. Push/Pulls: Types as indicated on Drawings; where not otherwise indicated manufacturer's standard types as selected by Architect; match finish of similar hardware as specified in Section 08 71 00.
 - e. Security Locks: Manufacturer's standard.
 - 1) Cylinders: Provided under Section 08 71 00.
 - f. Weather-Stripping, Sweep Strips: Manufacturer's recommended standard type, to suit application.
 - g. Thresholds: Maximum 1/2" height above adjacent surfaces, with maximum 1/4" vertical section and remainder maximum 1:2 slope.
- I. Glass: Provide minimum thicknesses specified, but no less than thicknesses required based on window size and configuration and anticipated wind loading.
1. Manufacturers:
 - a. Vitro Architectural Glass (formerly PPG).
 - b. Oldcastle Glass.

- c. Guardian Industries Corp.
 - d. Viracon.
 - e. Substitutions: Refer to Section 01 25 00.
- 2. Float Glass: Select glazing quality, clear float glass, ASTM C1036; nominal thickness 1/4".
- 3. Tempered Glass: Select glazing quality, clear float glass, fully tempered, ASTM C1048; nominal thickness 1/4"; safety glass.
- 4. Tinted Glass: Manufacturer's standard tint as directed by Architect.
 - a. Use one thickness of tinted glass throughout unless otherwise indicated or approved in advance by Architect.
- 5. Spandrel Glass: Double density ceramic frit, heat strengthened spandrel glass; nominal 1/4" thickness.
- 6. Laminated Glass: ASTM C1172, Kind LA, two sheets of clear float glass laminated with polyvinyl butyral film; safety glass; laminated layers free of air pockets and foreign substances.
 - a. Glass Thickness: Nominal 1/4", unless otherwise indicated.
 - b. Polyvinyl Butyral Core Thickness: Not less than 30 mil.
- 7. Insulated Glass: Preassembled units consisting of organically sealed panes of glass enclosing a hermetically sealed dehydrated air space with minus 20-degree F dew point.
 - a. Performance: Certified to ASTM E2190 by Insulating Glass Certification Council.
 - b. System: Manufacturer's standard dual seal system compatible with glazing system, and including spacers, desiccant, and standard corner construction.
 - c. Glass:
 - 1) Float Glass (Typical): Select glazing quality, clear float glass, ASTM C1036; nominal thickness 1/4".
 - 2) Tempered Glass (Where Indicated and Where Safety Glazing is Required): Select glazing quality, clear float glass, fully tempered, ASTM C1048, Kind FT; nominal thickness 1/4"; safety glass.
 - 3) Low Emissivity Coating: Provide high performance low e coating, not less than Vitro (PPG)/SolarBan 60, on Number 2 surface.
 - 4) Tinted Glass: As indicated, where not otherwise indicated manufacturer's standard tint as directed by Architect.
 - 5) Use one thickness of tinted glass throughout unless otherwise indicated or approved in advance by Architect.

- 6) Spandrel Glass: Double density ceramic frit, heat strengthened spandrel glass, ASTM C1048, Kind HS; nominal 1/4" thickness.
- d. Total Unit Thickness: 1".
- J. Glazing Accessories: Of type recommended by manufacturer to suit security locations and applications for dry glazing installation.
 1. Setting Blocks: Neoprene or EPDM, 80-90 Shore A durometer hardness; 4" long by 3/8" thick by 1/4" high; ASTM C864.
 2. Spacer Shims: Neoprene or EPDM; 45-55 Shore A durometer hardness; 3" long by 3/32" thick by 1/4" high; ASTM C864.
 3. Edge Blocks: Neoprene or EPDM, 60-70 Shore A durometer hardness; 4" long with minimum two per jamb located at top and bottom edges of glass; ASTM C864.
 4. Glazing Gaskets: Exterior neoprene or EPDM; interior neoprene, EPDM or vinyl; miter corner joints; ASTM C509 or C864.
- K. Miscellaneous Materials:
 1. Fasteners: Aluminum or non-magnetic stainless steel of type which will not cause electrolytic action or corrosion.
 - a. Do not use exposed fasteners except where unavoidable for assembly or for application of hardware.
 - b. Indicate exposed fasteners on shop drawings for specific approval; exposed fasteners shall be Phillips flat-head screws or Allen screws with finish matching item fastened.
 - c. Provide concealed fasteners for glazing stops.
 2. Steel Reinforcement and Brackets: Manufacturer's standard with minimum 2 oz. hot-dip zinc coating, ASTM A123, applied after fabrication.
 3. Bituminous Paint: Cold-applied mastic, SSPC Paint 12, compounded for 30 mil thickness per coat.
 4. Flashing: Provide sub-sill flashing members; minimum 22 gage sheet aluminum of sizes and shapes indicated and as required to drain water to exterior; match adjacent aluminum member finish.
 5. Anchoring Devices: Corrosion resistant type capable of supporting entrance system and superimposed design loads; design to allow adjustments of system prior to being permanently fastened in place.

2.3 FABRICATION

- A. Fabricate aluminum entrance and storefront system to allow for clearances and shim spacing around perimeter of assemblies to enable installation; provide for thermal movement.
- B. Provide anchorage devices to securely and rigidly fit entrance assemblies in place.
- C. Non-Automatic Doors: Comply with California Building Code and Americans with Disabilities Act (ADA) Standards relating to access for persons with disabilities.
 - 1. Clear Opening Width: Minimum 32" clear opening width for each door.
- D. Accurately fit together joints and corners; match components ensuring continuity of line and design; ensure joints and connections are flush, hairline and weatherproof.
- E. Provide structural reinforcing within framing members where required to maintain rigidity and as required to accommodate design loads.
- F. Allow moisture entering joints and condensation occurring within frame construction to drain to exterior.
- G. Complete cutting, fitting, forming, drilling and grinding of metal work prior to cleaning, finishing, treatment, and application of coating.
- H. Finishing: After fabrication, prepare surfaces for finishing in accordance with recommendations of aluminum producer and finish manufacturer.
 - 1. Finish components of each assembly simultaneously to attain uniformity of color.
- I. Weld by methods recommended by metal manufacturer and AWS; grind exposed welds smooth and restore mechanical finish; remove arises from cut edges and corners to a radius of approximately 1/64".
- J. Fit and assemble work at shop to greatest extent possible; disassemble only as required for shipment and erection.
- K. Reinforce work as necessary for performance requirements and for support.
- L. Provide internal reinforcing for hardware.
- M. Separate dissimilar materials with bituminous paint or preformed separators which will prevent corrosion.
- N. Separate metal surfaces at moving joints with plastic inserts or other non-abrasive concealed inserts which permanently prevent "freeze-up" of joint.
- O. Fabricate doors and apply hardware in shop. Disassemble only as required for transportation and installation.
- P. Apply coat of bituminous paint on concealed aluminum surfaces to be in contact with cementitious and with dissimilar materials.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install aluminum framed storefront assemblies, including entrances, in accordance with manufacturer's recommendations and installation instructions and to meet design criteria and performance criteria indicated, for weather-tight installation.
 - 1. Separate aluminum and other corrodible metal surfaces from sources of corrosion or electrolytic action at points of contact with other materials.
- B. Ensure assemblies are plumb, level and free of warp or twist; maintain dimensional tolerances and alignment with adjacent work.
 - 1. Maximum Variation from Plane or Location: 1/8" in 12'-0", with maximum 1/2" variation in total length.
 - 2. Maximum Offset Between Members: 1/16".
- C. Use sufficient anchorage devices to securely and rigidly fasten assemblies to building.
- D. Install hardware in accordance with manufacturer's recommendations, using proper templates.
 - 1. Install doors to operate freely and smoothly, with a maximum operating pressure of 5 pounds in accordance with California Building Standards Code.
 - 2. Coordinate installation of cylinders with Section 08 71 00 – Door Hardware.
 - 3. Install sill members and thresholds in bed of compound, joint fillers or gaskets to provide weathertight construction.
- E. Glass Installation: Comply with GANA Glazing Manual and glazing manufacturer instructions.
 - 1. Do not allow glass to touch metal surfaces.

3.2 CLEANING

- A. Clean aluminum surfaces promptly after installation of components, exercising care to avoid damage of finish.
- B. Mark glass after installation by crossed streamers attached to framing and held away from glass; do not apply markers to surface of glass.
- C. Remove nonpermanent labels immediately after sealant cures; cure sealants for high early strength and durability.

3.3 PROTECTION

- A. Remove and replace glass which is broken, chipped, cracked, abraded or damaged during construction period, including natural causes, accidents and vandalism.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions of Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes items known commercially as finish or door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.
- B. This Section includes the following, but is not necessarily limited to:
 - 1. Door Hardware, including electric hardware.
 - 2. Storefront and Entrance door hardware.
 - 3. Gate Hardware.
 - 4. Digital keypad access control devices.
 - 5. Hold-open closers with smoke detectors.
 - 6. Wall or floor-mounted electromagnetic hold-open devices.
 - 7. Power supplies for electric hardware.
 - 8. Low-energy door operators plus sensors and actuators.
 - 9. Thresholds, gasketing and weather-stripping.
 - 10. Door silencers or mutes.
- C. Related Sections: The following sections are noted as containing requirements that relate to this Section, but may not be limited to this listing.
 - 1. Division 8: Section - Steel Doors and Frames.
 - 2. Division 8: Section - Wood Doors.
 - 3. Division 8: Section - Aluminum Storefront
 - 4. Division 28: Section - Fire/Life-Safety Systems & Security Access Systems.

1.03 REFERENCES (USE DATE OF STANDARD IN EFFECT AS OF BID DATE.)

- A. 2022 California Building Code, CCR, Title 24.
- B. BHMA – Builders' Hardware Manufacturers Association
- C. CCR – California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.
- D. DHI – Door and Hardware Institute
- E. NFPA - National Fire Protection Association.
 - 1. NFPA 80 - Fire Doors and Other Opening Protectives
 - 2. NFPA 105 - Smoke and Draft Control Door Assemblies

F. UL - Underwriters Laboratories.

1. UL 10C - Fire Tests of Door Assemblies
2. UL 305 - Panic Hardware

G. WHI - Warnock Hersey Incorporated

H. SDI - Steel Door Institute

1.04 SUBMITTALS & SUBSTITUTIONS

- A. General: Submit in accordance with Conditions of the Contract and Division 1 Specification sections.
- B. Submit product data (catalog cuts) including manufacturers' technical product information for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
- C. Submit six (6) copies of schedule organized vertically into "Hardware Sets" with index of doors and headings, indicating complete designations of every item required for each door or opening. Include following information:
 1. Include a Cover Sheet with;
 - a. Job Name, location, telephone number.
 - b. Architects name, location and telephone number.
 - c. Contractors name, location, telephone number and job number.
 - d. Suppliers name, location, telephone number and job number.
 - e. Hardware consultant's name, location and telephone number.
 2. Job Index information included;
 - a. Numerical door number index including; door number, hardware heading number and page number.
 - b. Complete keying information (referred to DHI hand-book "Keying Systems and Nomenclature"). Provision should be made in the schedule to provide keying information when available; if it is not available at the time the preliminary schedule is submitted.
 - c. Manufacturers' names and abbreviations for all materials.
 - d. Explanation of abbreviations, symbols, and codes used in the schedule.
 - e. Mounting locations for hardware.
 - f. Clarification statements or questions.
 - g. Catalog cuts and manufacturer's technical data and instructions.
 3. Vertical schedule format sample:

Heading Number 1 (Hardware group or set number – HW -1)					
			(a) 1 Single Door #1 - Exterior from Corridor 101	(b) 90°	(c) RH
			(d) 3' 0"x7' 0" x 1-3/4" x (e) 20 Minute (f) WD x HM		
(g) 1	(h)	(i) ea	(j) Hinges - (k) 5BB1HW 4.5 x 4.5 NRP (l) ½ TMS	(m) 626	(n) IVE
2	6AA	1 ea	Lockset - ND50PD x RHO x RH x 10-025 x JTMS	626	SCH

(a) - Single or pair with opening number and location. (b) - Degree of opening (c) - Hand of door(s) (d) - Door and frame dimensions and door thickness. (e) - Label requirements if any. (f) - Door by frame material. (g) - (Optional) Hardware item line #. (h) - Keyset Symbol. (i) - Quantity. (j) - Product description. (k) - Product Number. (l) - Fastenings and other pertinent information. (m) - Hardware finish codes per ANSI A156.18. (n) - Manufacture abbreviation.

- D. Make substitution requests in accordance with Division 1. Substitution requests must be made prior to bid date. Include product data and indicate benefit to the project. Furnish samples of any proposed substitution.
- E. Wiring Diagrams: Provide product data and wiring and riser diagrams for all electrical products listed in the Hardware Schedule portion of this section.
- F. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.
- G. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- H. Furnish as-built/as-installed schedule with close-out documents, including keying schedule and transcript, wiring/riser diagrams, manufacturers' installation and adjustment and maintenance information.
- I. Fire Door Assembly Testing: Submit a written record of each fire door assembly to the Owner to be made available to the Authority Having Jurisdiction (AHJ) for future building inspections.

1.05 QUALITY ASSURANCE

- A. Obtain each type of hardware (latch and lock sets, hinges, closers, exit devices, etc.) from a single manufacturer.
- B. Supplier Qualifications: A recognized architectural door hardware supplier, with warehousing facilities in the project's vicinity, that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this project and that employs an experienced architectural hardware consultant (AHC) who is available to Owner, Architect, and Contractor, at reasonable times during the course of the Work, for consultation.
 - 1. Responsible for detailing, scheduling and ordering of finish hardware.
 - 2. Meet with Owner to finalize keying requirements and to obtain final instructions in writing.
 - 3. Stock parts for products supplied and are capable of repairing and replacing hardware items found defective within warranty periods.
- C. Hardware Installer: Company specializing in the installation of commercial door hardware with five years documented experience.
- D. Fire-Rated Openings: Provide door hardware for fire-rated openings that complies with NFPA Standard No. 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and tested by UL or Warnock Hersey for given type/size opening and degree of label. Provide proper latching hardware, door closers, approved-bearing hinges and seals whether listed in the Hardware Schedule or not.

1. Where emergency exit devices are required on fire-rated doors, (with supplementary marking on doors' UL labels indicating "Fire Door to be Equipped with Fire Exit Hardware") provide UL label on exit devices indicating "Fire Exit Hardware".
- E. Exit Doors: Operable from inside with single motion without the use of a key or special knowledge or effort.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Coordinate delivery of packaged hardware items to the appropriate locations (shop or field) for installation.
- B. Hardware items shall be individually packaged in manufacturers' original containers, complete with proper fasteners. Clearly mark packages on outside to indicate contents and locations in hardware schedule and in work.
- C. Provide locked storage area for hardware, protect from moisture, sunlight, paint, chemicals, etc.
- D. Contractor to inventory door hardware jointly with representatives of hardware supplier and hardware installer until each all are satisfied that count is correct.

1.07 WARRANTY

- A. Provide warranties of respective manufacturers' regular terms of sale from day of final acceptance as follows:
 1. Locksets: "ND" Ten (10) years.
 2. Electronic: One (1) year.
 3. Closers: Thirty (30) years.
 4. Exit devices: Three (3) years.
 5. All other hardware: Two (2) years.

1.08 MAINTENANCE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

1.09 PRE-INSTALLATION CONFERENCE

- A. Convene a pre-installation conference at least one week prior to beginning work of this section.
- B. Attendance: Architect, Construction Manager, Contractor, Security Contractor, Hardware Supplier, Installer, Key District Personnel, and Project Inspector.
- C. Agenda: Review hardware schedule, products, installation procedures and coordination required with related work. Review District's keying standards.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

<u>Item</u>	<u>Manufacturer</u>	<u>Acceptable Substitutes</u>
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Hinges	Ives	Hager, Stanley, McKinney
Locks, Latches & Cylinders	Schlage	Or Approved Equal
Exit Devices	Von Duprin	Or Approved Equal
Closers	LCN	Or Approved Equal
Push, Pulls & Protection Plates	Ives	Trimco, BBW, DCI
Flush Bolts	Ives	Trimco, BBW, DCI
Dust Proof Strikes	Ives	Trimco, BBW, DCI
Coordinators	Ives	Trimco, BBW, DCI
Stops	Ives	Trimco, BBW, DCI
Overhead Stops	Glynn-Johnson	Or Approved Equal
Thresholds	Zero	Pemko, National Guard
Seals & Bottoms	Zero	Pemko, National Guard

2.02 MATERIALS

- A. Hinges: Exterior out-swinging door butts shall be non-ferrous material and shall have stainless steel hinge pins. All doors to have non-rising pins.
 1. Hinges shall be sized in accordance with the following:
 - a. Height:
 - 1) Doors up to 42" wide: 4-1/2" inches.
 - 2) Doors 43" to 48" wide: 5 inches.
 - b. Width: Sufficient to clear frame and trim when door swings 180 degrees.
 - c. Number of Hinges: Furnish 3 hinges per leaf to 7'-5" in height. Add one for each additional 2 feet in height.
 2. Furnish non-removable pins (NRP) at all exterior out-swing doors and interior key lock doors with reverse bevels.
- B. Floor Closers: Shall be equipped with compression springs, cam and roller operating mechanism and a one piece spindle-cam for maximum operating performance and longevity.
- C. Pivots: High strength forgings and castings with precision bearings for smooth operation. Positive locking vertical adjustment mechanism to allow installer to precisely position the door and balance the load.
- D. Continuous Hinges: As manufactured by Ives, an Allegion Company. UL rated as required.
- E. Heavy Duty Cylindrical Locks and Latches: Schlage "ND" Series as scheduled with "Rhodes" design, fastened with through-bolts and threaded chassis hubs.

1. Provide cylindrical locksets exceeding the ANSI/BHMA A156.2 Grade 1 performance standards for strength, security, and durability in the categories below:
 - a. Abusive Locked Lever Torque Test – minimum 3,100 inch-pounds without gaining access
 - b. Offset lever pull – minimum 1,600 foot pounds without gaining access
 - c. Vertical lever impact – minimum 100 impacts without gaining access
 2. Cycle life - tested to minimum 16 million cycles per ANSI/BHMA A156.2 Cycle Test with no visible lever sag or use of performance aids such as set screws or spacers
 3. UL 10C for 4'-0" x 10'-0" 3-hour fire door.
 4. Cylinders: Refer to "KEYING" article, herein.
 5. Provide solid steel anti-rotation through bolts and posts to control excessive rotation of lever.
 6. Provide lockset that allows lock function to be changed to over twenty other common functions by swapping easily accessible parts.
 7. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2 inch latch throw capable of UL listing of 3 hours on a 4' x 10' opening. Provide proper latch throw for UL listing at pairs.
 8. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
 9. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
 10. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
 11. Provide wired electrified options as scheduled in the hardware sets.
 - a. 12 through 24 volt DC operating capability, auto-detecting
 - b. Selectable EL (fail safe)/EU (fail secure) operating mode via switch on chassis
 - c. 0.230A (230mA) maximum current draw
 - d. 0.010A (10mA) holding current
 - e. Modular / "plug in" request to exit switch
 12. Lever Trim: Solid cast levers without plastic inserts, and wrought roses on both sides.
- F. Networked Wireless Electronic Lock: Schlage "AD-400" Series as scheduled with "Rhodes" design, fastened with through-bolts and threaded chassis hubs.
1. Provide cylindrical locksets exceeding the ANSI/BHMA A156.2 Grade 1 performance standards for strength, security, and durability in the categories below:
 - a. Abusive Locked Lever Torque Test – minimum 3,100 inch-pounds without gaining access
 - b. Offset lever pull – minimum 1,600 foot pounds without gaining access
 - c. Vertical lever impact – minimum 100 impacts without gaining access
 2. Cycle life - tested to minimum 16 million cycles per ANSI/BHMA A156.2 Cycle Test with no visible lever sag or use of performance aids such as set screws or spacers
 3. UL 10C for 4'-0" x 10'-0" 3-hour fire door.
 4. Cylinders: Refer to "KEYING" article, herein.
 5. Programming done by owner or division 28.
- G. Deadlocks: Rotating cylinder trim rings of attack-resistant design. Mounting plates and actuator shields of plated cold-rolled steel. Mounting screws of 1/4" diameter steel and protected by drill-resistant ball bearings. Steel alloy deadbolt with hardened steel roller. Strike alloy deadbolt with reinforcer and two 3" long screws. ANSI A156.5, 2001 Grade 1 certified.
- H. Exit devices: Von Duprin as scheduled.

1. Provide certificate by independent testing laboratory that device has completed over 1,000,000 cycles and can still meet ANSI/BHMA A156.3 - 2001 standards.
 2. All internal parts shall be of cold-rolled steel with zinc dichromate coating.
 3. Mechanism case shall have an average thickness of .140".
 4. Compression spring engineering.
 5. Non-handed basic device design with center case interchangeable with all functions.
 6. All devices shall have quiet return fluid dampeners.
 7. All latchbolts shall be deadlocking with ¾" throw and have a self-lubricating coating to reduce friction and wear.
 8. Device shall bear UL label for fire and or panic as may be required.
 9. All surface strikes shall be roller type and utilize a plate underneath to prevent movement.
 10. Lever Trim: "Breakaway" design, forged brass or bronze escutcheon with a minimum of .130" thickness, match lockset lever design.
 11. Removable Mullions: Removable with single turn of building key. Securely reinstalled without need for key.
 12. Furnish glass bead kits for vision lites where required.
 13. All Exit Devices to be sex-bolted to the doors.
 14. Panic Hardware shall comply with CBC Section 11B.404.2.7 and shall be mounted between 34" and 44" above the finished floor surface.
 - a. Provide exit devices UL certified to meet maximum 5 pound requirements according to the California Building Code section 11B-309.4, and UL listed for Panic Exterior Fire Exit Hardware.
- I. Closers: LCN as scheduled. Place closers inside building, stairs, room, etc.
1. Door closer cylinders shall be of high strength cast iron construction with double heat treated pinion shaft to provide low wear operating capabilities of internal parts throughout the life of the installation. All door closers shall be tested to ANSI/BHMA A156.4 test requirements by a BHMA certified testing laboratory. A written certification showing successful completion of a minimum of 10,000,000 cycles must be provided.
 2. All door closers shall be fully hydraulic and have full rack and pinion action with a shaft diameter of a minimum of 11/16 inch and piston diameter of 1 inch to ensure longevity and durability under all closer applications.
 3. All parallel arm closers shall incorporate one piece solid forged steel arms with bronze bushings. 1-9/16" steel stud shoulder bolts, shall be incorporated in regular arms, hold-open arms, arms with hold open and stop built in. All other closers to have forged steel main arms for strength, durability, and aesthetics for versatility of trim accommodation, high strength and long life.
 4. All parallel arm closers so detailed shall provide advanced backcheck for doors subject to severe abuse or extreme wind conditions. This advanced backcheck shall be located to begin cushioning the opening swing of the door at approximately 45 degrees. The intensity of the backcheck shall be fully adjustable by tamper resistant non-critical screw valve.
 5. Closers shall be installed to permit doors to swing 180 degrees.
 6. All closers shall utilize a stable fluid withstanding temperature range of 120 degrees F. to -30 degrees F. without requiring seasonal adjustment of closer speed to properly close the door.
 7. Provide the manufactures drop plates, brackets and spacers as required at narrow head rails and special frame conditions. NO wood plates or spacers will be allowed.
 8. Maximum effort to operate closers shall not exceed 5 lbs., such pull or push effort being applied at right angles to hinged doors. Compensating devices or automatic door operators may be utilized to meet the above standards. When fire doors are required, the maximum effort to operate the closer may be increased but shall not exceed 15 lbs. when specifically approved by fire marshal. All closers shall be adjusted to operate with the minimum amount of opening force and still close and latch the door. 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. Per 11B-404.2.8.1, door shall take at least 5 seconds to move from an open position of 90 degrees to a position of 12 degrees from the latch jamb.

- J. Flush Bolts & Dust Proof Strikes: Automatic Flush Bolts shall be of the low operating force design. Utilize the top bolt only model for interior doors where applicable and as permitted by testing procedures.
 - 1. Manual flush bolts only permitted on storage or mechanical openings as scheduled.
 - 2. Provide dust proof strikes at openings using bottom bolts.
- K. Door Stops:
 - 1. Unless otherwise noted in Hardware Sets, provide floor type with appropriate fasteners. Where wall type cannot be used, provide floor type. If neither can be used, provide overhead type.
 - 2. Do not install floor stops more than four (4) inches from the face of the wall or partition (CBC Section 11B-307).
 - 3. Overhead stops shall be made of stainless steel and non-plastic mechanisms and finished metal end caps. Field-changeable hold-open, friction and stop-only functions.
- L. Protection Plates: Fabricate either kick, armor, or mop plates with four beveled edges. Provide kick plates 10" high and 2" LDW. Sizes of armor and mop plates shall be listed in the Hardware Schedule. Furnish with machine or wood screws of bronze or stainless to match other hardware.
- M. Thresholds: As Scheduled and per details.
 - 1. Thresholds shall not exceed 1/2" in height, with a beveled surface of 1:2 maximum slope.
 - 2. Set thresholds in a full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements in Division 7 "Thermal and Moisture Protection".
 - 3. Use 1/4" fasteners, red-head flat-head sleeve anchors (SS/FHSL).
 - 4. Thresholds shall comply with CBC Section 11B-404.2.5.
- N. Seals: Provide silicone gasket at all rated and exterior doors.
 - 1. Fire-rated Doors, Resilient Seals: UL10C Classified complies with NFPA 80 & NFPA 252. Coordinate with selected door manufacturers' and selected frame manufacturers' requirements.
 - 2. Fire-rated Doors, Intumescent Seals: Furnished by selected door manufacturer. Furnish fire-labeled opening assembly complete and in full compliance with UL10C Classified complies with NFPA 80 & NFPA 252. Where required, intumescent seals vary in requirement by door type and door manufacture -- careful coordination required.
 - 3. Smoke & Draft Control Doors, Provide UL10C Classified complies with NFPA 80 & NFPA 252 for use on "S" labeled Positive Pressure door assemblies.
- O. Door Shoes & Door Top Caps: Provide door shoes at all exterior wood doors and top caps at all exterior out-swing doors.
- P. Silencers: Furnish silencers for interior hollow metal frames, 3 for single doors, 2 for pairs of doors. Omit where sound or light seals occurs, or for fire-resistive-rated door assemblies.

2.03 KEYING

- A. Furnish a Proprietary Schlage masterkey system as directed by the owner or architect. Key system to be designated and combined by the Schlage Master Key Department even if pinned by the Authorized Key Center, Authorized Security Center or a local authorized commercial dealer.
- B. A detailed keying schedule is to be prepared by the owner and/or architect in consultation with a representative of Allegion or an Authorized Key Center or Authorized Security Center. Each keyed cylinder on every keyed lock is to be listed separately showing the door #, key group (in BHMA terminology), cylinder type, finish and location on the door.
- C. Furnish all cylinders in the Schlage conventional style except the exit device and removable mullion cylinders which will be supplied in Schlage Full Size Interchangeable Core (FSIC). Pack change keys independently (PKI).
- D. Furnish construction keying for doors requiring locking during construction.
 - 1. For FSIC systems provide 23-030-ICX Full Size Construction Cores
 - 2. For FSIC systems provide ten 48-101-ICX Construction Keys
 - 3. For FSIC systems provide two 48-056-ICX Control Keys (const.)
 - 4. For FSIC systems provide two control keys for installing the permanent cores (49-056 for "Classic" keyways, 48-052-XP for "Classic Primus") (49-003 for "Everest Conventional", 48-005-XP for "Everest Primus")
- E. Furnish all keys with visual key control.
 - 1. Stamp key "Do Not Duplicate".
 - 2. Stamp (BHMA) key symbol on key.
- F. Furnish all cylinders with visual key control.
 - 1. Stamp (BHMA) key symbol on side of cylinder (CKC).
- G. Furnish mechanical keys as follows:
 - 1. Furnish 2 cut change keys for each different change key code.
 - 2. Furnish 1 uncut key blank for each change key code.
 - 3. Furnish 6 cut masterkeys for each different masterkey set.
 - 4. Furnish 3 uncut key blanks for each masterkey set.
 - 5. Furnish 2 cut control keys cut to the top masterkey for permanent I/C cylinders.
 - 6. Furnish 1 cut control key cut to each SKD combination.
- H. Furnish Key System Management Software (SM01-287 Windows on CD)
- I. Furnish Keying Transcript (50-123 in SM form) to owner for loading into key system software. End-user to provide letter of authorization to hardware dealer to allow Schlage to e-mail transcript (bitting list) to the end-user.
- J. Furnish Schlage Padlocks and the cylinders to tie them into the masterkey system for gates, storage boxes, utility valve security, roof hatches and roll-up doors keyed as directed in the keying schedule.
 - 1. Furnish KS43D2200 padlock for use with non-I/C Schlage cylinders. Furnish 47-413 (conventional) or 47-743-XP (PrimusXP) with above.
 - 2. Furnish KS43G3200 padlock for use with FSIC Schlage cylinders. Furnish 23-030 (Classic / Everest) or 20-740 (PrimusXP) with above.

3. Furnish KS41D1200 padlock for use with SFIC Schlage cylinders. Furnish 80-037 (Everest-B) with above.
- K. Furnish one Schlage cabinet lock for each cabinet door or drawer so designated on the drawings or keying schedule to match the masterkey system.
 1. Furnish CL100PB for use with non-I/C Schlage cylinders.
 2. Furnish CL77R for use with FSIC Schlage cylinders.
 3. Furnish CL721G for use with SFIC Schlage cylinders.

2.04 FINISHES

- A. Generally to be satin chrome US26D (626 on bronze and 652 on steel) unless otherwise noted.
- B. Furnish push plates, pull plates and kick or armor plates in satin stainless steel US32D (630) unless otherwise noted.
- C. Door closers shall be powder-coated to match other hardware, unless otherwise noted.
- D. Aluminum items to be finished anodized aluminum except thresholds which can be furnished as standard mill finish.

2.05 FASTENERS

- A. Screws for strikes, face plates and similar items shall be flat head, countersunk type, provide machine screws for metal and standard wood screws for wood.
- B. Screws for butt hinges shall be flathead, countersunk, full-thread type.
- C. Fastening of closer bases or closer shoes to doors shall be by means of sex bolts and spray painted to match closer finish.
- D. Provide expansion anchors for attaching hardware items to concrete or masonry.
- E. All exposed fasteners shall have a phillips head.
- F. Finish of exposed screws to match surface finish of hardware or other adjacent work.
- G. All Exit Devices and Lock Protectors shall be fastened to the door by the means of sex bolts or through bolts.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Verify that doors and frames are square and plumb and ready to receive work and dimensions are as instructed by the manufacturer.
- B. Beginning of installation means acceptance of existing conditions.

3.02 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions and requirements of DHI.

- B. Use the templates provided by hardware item manufacturer.
- C. Mounting heights for hardware shall be as recommended by the Door and Hardware Institute. Operating hardware will to be located between 34" and 44" AFF.
- D. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units that are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- F. Set thresholds for exterior doors in full bed of butyl-rubber sealant.
- G. If hand of door is changed during construction, make necessary changes in hardware at no additional cost.
- H. Hardware Installer shall coordinate with security contractor to route cable to connect electrified locks, panic hardware and fire exit hardware to power transfers or electric hinges at the time these items are installed so as to avoid disassembly and reinstallation of hardware.
- I. Hardware Installer shall also be present with the security contractor when the power is turned on for the testing of the electronic hardware applications. Installer shall make adjustments to solenoids, latches, vertical rods and closers to insure proper and secure operation.
- J. All wiring for electro-mechanical hardware mounted on the door shall be connected through the power transfer and terminated in the interface junction box specified for in the Electrical Section.
- K. Conductors shall be minimum 18 gage stranded, multicolored. A minimum 12 in. loop of conductors shall be coiled in the interface junction box. Each conductor shall be permanently marked with its function.
- L. If a power supply is specified in the hardware sets, all conductors shall be terminated in the power supply. Make all connections required for proper operation between the power supply and the electro-mechanical hardware. Provide the proper size conductors as specified in the manufacturer's technical documentation.

3.03 ADJUST AND CLEAN

- A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.
- B. Clean adjacent surface soiled by hardware installation.
- C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy, return to that work area and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
- D. Instruct Owner's Personnel in proper adjustment and maintenance of hardware finishes, during the final adjustment of hardware.

- E. Continued Maintenance Service: Approximately six months after the completion of the project, the Contractor accompanied by the Architectural Hardware Consultant, shall return to the project and re-adjust every item of hardware to restore proper functions of doors and hardware. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

3.04 HARDWARE LOCATIONS

- A. Conform to CCR, Title 24, Part 2; and ADAAG; and the drawings for access-compliant positioning requirements for the disabled.

3.05 FIELD QUALITY CONTROL

- A. Contractor is responsible for providing the services of an Architectural Hardware Consultant (AHC) or a proprietary product technician to inspect installation and certify that hardware and its installation have been furnished and installed in accordance with manufacturers' instructions and as specified herein.

3.06 SCHEDULE

- A. The items listed in the following schedule shall conform to the requirements of the foregoing specifications.
- B. While the hardware schedule is intended to cover all doors, and other movable parts of the building, and establish type and standard of quality, the contractor is responsible for examining the Plans and Specifications and furnishing proper hardware for all openings whether listed or not. If there are any omissions in hardware groups in regard to regular doors they shall be called to the attention of the Architect prior to bid opening for instruction; otherwise, list will be considered Complete. No extras will be allowed for omissions.
- C. The Door Schedule on the Drawings indicates which hardware set is used with each door.

Manufacturers Abbreviations (Mfr.)

ADA	=	Adams Rite Mfg.	Aluminum Door Hardware
GLY	=	Glynn-Johnson Corporation	Overhead Door Stops
IVE	=	Ives	Hinges, Pivots, Bolts, Coordinators, Dust Proof Strikes, Push Pull & Kick Plates, Door Stops & Silencers
JOH	=	L.E. Johnson	Sliding Door Hardware
LCN	=	LCN	Door Closers
SCE	=	Schlage Electronics	Electronic Door Components
SCH	=	Schlage Lock Company	Locks, Latches & Cylinders
TRI	=	Trimco	Signs
VON	=	Von Duprin	Exit Devices
ZER	=	Zero International	Thresholds, Gasketing & Weather-stripping

SPEXTRA: 419886

HARDWARE GROUP NO. 01

3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	PRIVACY LOCK	ND40S RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP	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

HARDWARE GROUP NO. 02

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	ELEC PANIC HARDWARE	AX-99-L	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	FLOOR STOP/HOLDER	FS40	626	IVE
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	330	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	AL	ZER

HARDWARE GROUP NO. 03

3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	ELEC CLASSROOM LOCK	AD-400-CY-70-KP-RH-P	626	SCE
1	EA	SURFACE CLOSER	4040XP	689	LCN
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

END OF SECTION

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SECTION 08 80 00

GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Provide miscellaneous glass and glazing not provided elsewhere including accessories as required for complete installation.
 - a. Provide glazing for metal doors and frames.

B. Related Sections:

1. Section 08 41 00: Aluminum-framed entrances and storefronts glazing.
2. Section 10 28 00: Metal framed mirrors.

1.2 REFERENCES

- A. Glass Association of North America (GANA): Glazing Manual and Sealant Manual.**

1.3 SUBMITTALS

- A. Product Data:** Furnish for each type of glass and exposed glazing material.
- B. Samples:** Furnish samples of exposed glazing accessories.

1.4 WARRANTY

- A. Extended Correction Period:** Extend correction period to two years for following.
1. Replacing laminated glass which exhibits signs of delaminating.
 2. Replacing insulated glass which exhibits signs of moisture on sealed glass surfaces.
 3. Replacing mirrors which exhibit signs of desilvering or signs of distortion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. System Description:** Section includes miscellaneous glass and glazing materials for items typically furnished without glazing and where glazing is not an integral part of the assembly.
- B. Regulatory Requirements:**

1. Safety Glass Standard: Comply with applicable codes, CPSC 16 CFR 1201, and pass ANSI Z97.1.
 2. Fire Rated Glass: Provide glass identical to glass tested per ASTM E163, labeled and listed by UL or other testing and inspection agency acceptable to applicable authorities.
- C. Float Glass: Select glazing quality, clear annealed glass, ASTM C1036; nominal thickness 1/4".
1. Manufacturers:
 - a. Vitro Architectural Glass (formerly PPG).
 - b. Oldcastle Glazing.
 - c. Guardian Industries Corp.
 - d. Substitutions: Refer to Section 01 25 00.
 2. Locations: Provide where indicated as clear glass.
- D. Tempered Glass: Select glazing quality, clear float glass, fully tempered, ASTM C1048, Kind FT; nominal thickness 1/4"; safety glass.
1. Manufacturers:
 - a. Vitro Architectural Glass (formerly PPG).
 - b. Oldcastle Glazing.
 - c. Guardian Industries Corp.
 - d. Substitutions: Refer to Section 01 25 00.
 2. Locations: Provide at doors and at window openings where required by applicable codes and federal requirements.
- E. Laminated Glass: ASTM C1172, Kind LA, two sheets of select glazing quality clear float glass laminated with polyvinyl butyral film, safety glass; laminated layers shall be free of air pockets and foreign substances.
1. Manufacturers:
 - a. Vitro Architectural Glass (formerly PPG).
 - b. Oldcastle Glazing.
 - c. Guardian Industries Corp.
 - d. Global Security Glazing.
 - e. Pulp Studio, Inc.
 - f. Substitutions: Refer to Section 01 25 00.
 2. Glass Thickness: 1/4", unless otherwise indicated.
 3. Polyvinyl Butyral Core Thickness: Minimum 30 mil.
 4. Location: Provide where indicated.

- F. Insulated Glass: Preassembled units consisting of organically sealed panes of glass enclosing a hermetically sealed dehydrated air space with minus 20-degree F dew point.
1. Manufacturers:
 - a. Vitro Architectural Glass (formerly PPG).
 - b. Oldcastle Glazing.
 - c. Guardian Industries Corp.
 - d. Viracon.
 - e. Substitutions: Refer to Section 01 25 00.
 2. Performance: Certified to ASTM E2190 by Insulating Glass Certification Council.
 3. System: Manufacturer's standard dual seal system compatible with glazing system, and including spacers, desiccant, and standard corner construction.
 4. Glass: ASTM C1036, select glazing quality clear float glass; nominal 1/4" thick glass.
 5. Safety Glass: ASTM C1048, Kind FT, fully tempered select glazing quality clear float glass; nominal 1/4" thick glass; provide at doors and impact areas where safety glass is required by applicable codes and regulations.
 6. Total Unit Thickness: 1".
 7. Locations: Provide at exterior windows and doors unless otherwise indicated.
- G. Wired Glass (Skylights and Non-Impact Areas): Glazing quality, wired glass, polished both surfaces; square mesh, conforming to ASTM C1036; nominal thickness 1/4"; UL listed fire rated glass.
1. Manufacturers:
 - a. Nippon Sheet Glass.
 - b. Ashai Glass Co.
 - c. Substitutions: Refer to Section 01 25 00.
 2. Glazing Materials: Type approved for use in applications indicated for required fire ratings; refer to fire label requirements.
 3. Location: Provide at skylights and fire rated not requiring impact resistance.
- H. Wired Glass (Doors and Impact Areas): Glazing quality, clear fire rated wired glass, polished both surfaces; square mesh, nominal thickness 1/4"; UL listed fire rated glass and suitable for applications and fire ratings indicated on Drawings.
1. Manufacturers:
 - a. Technical Glass Products/Pilkington WireLite NT and Pyroshield Plus.
 - b. SAFTI First/SuperLite I-W.
 - c. Substitutions: Refer to Section 01 25 00.

2. Glazing Materials: Type approved for use in applications indicated for required fire ratings; refer to fire label requirements.
 3. Location: Provide at fire rated openings indicated to receive wired glass.
- I. Clear Fire Rated, Impact Resistant Glass: Glazing quality, clear fire rated glass, polished both surfaces; nominal thickness 1/4"; UL listed clear fire rated glass; suitable for applications and fire ratings indicated on Drawings.
1. Manufacturers:
 - a. AGC InterEdge Technologies/Pyrobel.
 - b. Technical Glass Products/Pilkington Pyrodur and Pyrostop.
 - c. SAFTI First/SuperLite 20, SuperLite I XL, and SuperLite I XL IGU.
 - d. Substitutions: Refer to Section 01 25 00.
 2. Glazing Materials: Type approved for use in applications indicated for required fire ratings; refer to fire label requirements.
 3. Location: Provide at fire rated openings indicated to receive clear fire rated glass.
 - a. Hose Stream Test: Provide appropriate glazing for specific conditions indicated including but not limited to fire rated impact resistant glass required by applicable codes to pass hose stream test.
- J. One Way Reflective Mirror Glass:
1. Manufacturers:
 - a. Globe Amerada Glass Co./Transparent Mirro Glass.
 - b. Pilkington/Mirropane E.P.
 - c. Substitutions: Refer to Section 01 25 00.
 2. Glazing Materials: Types as recommended by one-way mirror manufacturer.
- K. Polycarbonate Mirror:
1. Manufacturers:
 - a. Bunker Plastics, Inc.
 - b. Substitutions: Refer to Section 01 25 00.
 2. Glazing Materials: Types as recommended by one-way mirror manufacturer.
- L. Spacer Shims: Silicone compatible, 50 durometer hardness; 3" long by 3/32" thick by 1/4" high.
- M. Setting Blocks: 70-90 durometer hardness; 4" long by 3/8" thick by 1/4" high standard setting blocks.
- N. Glazing Sealant: ASTM C920, Type S, Grade NS, elastomeric one-component silicone glazing sealants as recommended by sealant manufacturer for application involved.

1. Manufacturers:
 - a. Dow Corning Corp.
 - b. General Electric Co.
 - c. Pecora Corp.
 - d. Substitutions: Refer to Section 01 25 00.
 2. Structural and Butt Glazing: Provide high-modulus structural silicone glazing materials recommended by sealant manufacturer for applications where sealant bonds glass to metal system and where sealant bonds glass to glass.
 3. Color: As selected by Architect from manufacturer's full range of available colors.
- O. Glazing Putty: Linseed oil putty, ASTM C570, Type II; oil and resin base caulking compound for building construction; knife grade.1.
1. Manufacturers:
 - a. DAP, Inc.
 - b. Substitutions: Refer to Section 01 25 00.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean glazing channels and framing members to receive glass immediately before glazing; remove coatings not firmly bonded to substrate.
- B. Apply primer to joint surfaces where recommended by sealant manufacturer.

3.2 INSTALLATION

- A. Comply with GANA Glazing Manual and Sealant Manual and glazing manufacturer recommendations and installation instructions.
 1. Do not allow glass to touch metal surfaces.
 2. Comply with applicable code requirements and NFPA 80 for glass in fire rated openings.
- B. Place setting blocks at quarter points in thin course of sealant.
- C. Install removable stops with glass centered in space with spacer shims at 2'-0" intervals on both sides of glass, 1/4" below sightline.
- D. Sealant Glazing: Fill gap between glass and stops with sealant to depth equal to bite of frame on glass but not more than 3/8" below sightline.
 1. Apply sealant to uniform and level line, flush with sightline; tool or wipe sealant surface for smooth appearance; at exterior locations tool sealant so water is carried away from glass.

3.3 CLEANING

- A. At areas subject to potential impact mark glass after installation by crossed streamers attached to framing and held away from glass; do not apply markers to surface of glass.
- B. Remove nonpermanent labels immediately after sealant cures; cure sealants for high early strength and durability.
- C. Remove and replace glass which is broken, chipped, cracked, abraded or damaged during construction period, including natural causes, accidents and vandalism.

END OF SECTION

SECTION 08 83 00

FRAMELESS MIRRORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Typical: Provide frameless glass mirrors with accessories as required for complete installation.
2. Impact Locations: Provide laminated frameless glass mirrors with accessories as required for complete installation.

B. Related Sections:

1. Section 08 80 00: One-way mirrors and polycarbonate mirrors.

1.2 REFERENCES

- A. Glass Association of North America (GANA): Glazing Manual and Sealant Manual.**

1.3 SUBMITTALS

- A. Product Data:** Furnish for mirror glass.

- B. Samples:** Furnish samples of mirror glass with finished edges and corners.

1.4 WARRANTY

- A. Special Warranties:** Replace mirrors which exhibit signs of desilvering or signs of distortion.

1. Special Warranty Period: Two years.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. System Description:** Provide frameless mirrors with accessories as required for complete installation.

1. Provide ballet barres where indicated.

- B. Safety Glass Standard:** Comply with applicable codes, CPSC 16 CFR 1201, and pass ANSI Z97.1.

- C. Typical Frameless Glass Mirrors: Mirror quality q1 or q2, clear float glass; 1/4" thick; full silver coating, copper coating and organic coating; factory treated and sealed after cutting and finishing.
 - 1. Manufacturers:
 - a. Guardian Glass.
 - b. Lenoir Mirror Company, Lenoir, NC.
 - c. Substitutions: Refer to Section 01 25 00.
 - 2. Edges: Provide edges designed to eliminate cutting potential at edges and corners commonly referred to as arrised edges, as approved by Architect.
- D. Laminated Glass Frameless Mirrors: ASTM C1172, Kind LA, two sheets of clear float glass laminated with polyvinyl butyral film, safety glass; laminated layers shall be free of air pockets and foreign substances.
 - 1. Manufacturers:
 - a. Oldcastle BuildingEnvelope.
 - b. Guardian Industries Corp.
 - c. Global Security Glazing.
 - d. Pulp Studio, Inc.
 - e. Substitutions: Refer to Section 01 25 00.
 - 2. Glass: Mirror quality q1 or q2, clear float glass; factory treated and sealed after cutting and finishing.
 - 3. Edges: Provide edges designed to eliminate cutting potential at edges and corners commonly referred to as arrised edges, as approved by Architect.
 - 4. Glass Thickness: Nominal 1/4" total thickness unless otherwise indicated.
 - 5. Polyvinyl Butyral Core Thickness: Minimum 30 mil.
 - 6. Reflective Coating: Coating may be standard full silver reflective metallic coating on Number 2 surface or may be mirror reflective surface on polyvinyl butyral core.
- E. Mirror Attachment:
 - 1. Bottom Supports: Brite anodized aluminum angles such as Glass Distributors Inc. (301.779.2430)/Brite Anodized Aluminum 3/8" L-Bar Extrusion, provide felt pads for setting mirrors on angles; provide concealed fasteners.
 - 2. Adhesive: Nontoxic type as recommended by mirror manufacturer.

- F. Ballet Barres and Supports: Standard wood 1-1/2" diameter ballet barre with fixed ballet bar supports designed specifically for ballet barre installation over mirror without ballet barre supports touching mirror.

1. Manufacturers:

- a. BuyRailings (877.810.4116).
- b. WallBarre (864.288.8934).
- c. MatsMatsMats (877.777.6287).
- d. Substitutions: Refer to Section 01 25 00.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with GANA Glazing Manual and mirror manufacturer instructions.
 - 1. Do not allow glass to touch metal surfaces.
- B. Provide ventilation to coating.
- C. Set or trim felt to face of mirror.
- D. Install ballet barre in accordance with ballet barre manufacturer recommendations and installation instructions without touching mirror.

3.2 CLEANING

- A. Remove nonpermanent labels immediately after installation.
- B. Remove and replace mirrors which are broken, chipped, cracked, abraded or damaged during construction period, including natural causes, accidents and vandalism.

END OF SECTION

SECTION 08 91 00

LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide extruded aluminum louvers and frames, with screens, attachment hardware, and accessories as required for complete finished installation.
- B. Related Sections:
 - 1. Section 08 11 10: Steel door louvers.

1.2 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature for each type of louver.
- B. Shop Drawings: Indicate profile of frame, details, relation to adjacent construction, flashing, blade configuration, duct work connection, screens, and percentage of free air opening.
- C. Samples: Furnish samples of metal finish.
- D. Certificates: Where performance requirements are included, provide AMCA Certified Rating Seal indicating louvers comply with requirements.

1.3 SITE CONDITIONS

- A. Take site dimensions affecting louvers prior to fabrication.
- B. Ensure openings are properly prepared and flashings are correctly located to divert moisture to exterior.
- C. Protect adjacent surfaces, finishes and materials from damage during installation of louvers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The Airolite Corporation.
- B. Construction Specialties, Inc. (CSI).
- C. Nystrom Building Products.
- D. Airline Products Co.
- E. Ruskin.

F. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide extruded aluminum louvers and frames, with screens, attachment hardware, and accessories.
- B. Performance Criteria: Where indicated, comply with specific performance requirements; unit performance ratings determined in compliance with Air Movement and Control Association (AMCA) Standard 500 - L.
 - 1. Free Area: Minimum 45% based on 48" by 48" louver.
 - 2. Static Pressure Loss: Maximum 0.15" of water gage at airflow of 1000 fpm free air velocity.
 - 3. Water Penetration: Maximum 0.05 oz/sf of free area at intake airflow of 1000 fpm free area velocity.
 - 4. Wind-Driven Rain: Louvers shall achieve a wind-driven rating in conformance with applicable codes and regulations but not less than an A rating on a standard size louver as defined in AMCA 500 - L.
- C. Aluminum Extrusions: ASTM B221, alloy 6061 or 6063, temper T5 or T6; minimum 0.08" thick.
- D. Aluminum Sheet: ASTM B209, manufacturer's standard alloy; minimum 0.08" thick.

2.3 FABRICATION

- A. Louvers: Manufacturer's standard fabrication for types specified and configurations indicated on Drawings.
 - 1. Type: Extruded aluminum wall louvers, continuous blade (mullionless) type.
 - 2. Type: Extruded aluminum wall louvers, fixed blade mullion type.
- B. Bird Screen for Exterior Louvers: Minimum 0.063" diameter wire, 1/2" interwoven square mesh.
 - 1. Wire: Stainless-steel.
 - 2. Frame: Match louver.
- C. Fabricate louvers to maximum extent possible and disassemble as necessary for shipping and handling limitations; clearly mark units for reassembly and installation.
 - 1. Fabricate frames, including integral sills, to suit adjacent construction with tolerances for installation.
 - 2. Fabricate sill extension, flashings, wall anchors, structural supplementary sub-framing, and accessories as required for complete system; use same materials as provided for louvers.

- D. Join frame members and louver blades by welding; maintain equal blade spacing, including separation between blades and frame head and sill; maintain uniform appearance.
 - 1. Shop miter and weld blades into shop fabricated corner units to align with straight sections; include concealed bracing.
- E. Shop Finished Louvers: Factory finish with fluoropolymer coating based on Kynar 500 or Hylar 5000 and conforming with AAMA 2605; not less than two-coat system.
 - 1. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect including metallic finish based on mica.
- F. Shop Primed Louvers: Manufacturer's standard thermosetting prime coating compatible with paints specified in Section 09 90 00 - Painting and Coating.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install louvers in accordance with manufacturer recommendations and installation instruction, properly aligned and level.
- B. Secure louver rigid with concealed fasteners of non-corrosive metals to suit materials being encountered and to resist anticipated loads.
- C. Coordinate installation method with application of adjacent backing and structural elements, and mechanical work.
- D. Set and tie into flashings to ensure diversion of moisture to exterior.
- E. Hinge screens for access.

END OF SECTION

SECTION 09 01 20

PLASTER PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Patch exterior Portland cement plaster to match existing.
2. Patch interior gypsum plaster to match existing.
3. Patch existing lath where deteriorated and where damaged during construction operations.

1.2 REFERENCES

- A. ASTM C841: Installation of Interior Lathing and Furring.
- B. ASTM C842: Application of Interior Gypsum Plaster.
- C. ASTM C926: Application of Portland Cement Based Plaster.
- D. ASTM C1063: Installation of Lathing and Furring For Portland Cement Plaster.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Pre-Installation Meeting: Convene not less than one week prior to commencing work of this Section. Require attendance of those directly affecting work of this Section.
 1. Review installation procedures and coordination required with related work.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's product specifications for each lathing material and accessory.
- B. Mock-Up: Provide mock-up of each type of plaster patching.

1.5 PROJECT CONDITIONS

- A. Take precautionary measures to ensure excessive temperature changes do not occur.
- B. Cold-Weather Requirements: Do not apply plaster unless minimum ambient temperature of 50 degrees F has been and continues to be maintained for minimum 48 hours prior to application and until plaster is cured.

- C. Hot-Weather Requirements: Protect plaster from uneven and excessive evaporation during hot, dry weather.
- D. Interior Plaster: Provide heat and ventilation in interior areas where plaster work is being performed, so as to allow plaster to properly cure.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. System Description: Provide materials for patching existing plaster systems including lath and accessories which are deteriorated, and which are damaged by construction operations including plaster patching.
- B. Regulatory Requirements: Where assemblies are fire rated, provide materials acceptable to applicable authorities for required fire ratings.
 - 1. Provide materials required for systems listed by Underwriters Laboratory, Gypsum Association (GA) File No's in GA-600 Fire Resistance Design Manual, or other listing approved by applicable authorities.
- C. Portland Cement Plaster: Provide either neat or ready-mixed (where applicable) materials, at Contractor's option, complying with ASTM C926.
 - 1. Basecoat Materials:
 - a. Cement: Normal Type 1 or 1A Portland cement, ASTM C150.
 - b. Lime: Special finishing hydrated lime, Type S, ASTM C206.
 - c. Aggregate: Natural sand, conforming to ASTM C897 or C144.
 - 2. Brown Coat Water Acrylic Admix: Acrylic latex admix specifically manufactured for use in Portland Cement Plaster applications and which will not detrimentally effect finish.
 - a. Manufacturers:
 - 1) Larsen Products Corp./Acrylic Admix 101.
 - 2) Thoro System Products, Inc./Acryl 60.
 - 3) Chem-Masters Corp./Cretelox.
 - 4) Substitutions: Refer to Section 01 25 00.
 - 3. Finishing Materials: Same as basecoat with acrylic admix. Factory premix finish coat is acceptable.
 - a. Provide white cement from a single manufacturer and clear silica sand at applications indicated to have integral color.

4. Portland Cement Plaster Bonding Agents: ASTM C932 bonding agent as recommended by manufacturer for Portland cement exterior applications.
 - a. Manufacturers:
 - 1) Larsen Product Corp./Weld-Crete.
 - 2) Thoro System Products, Inc./Thorobond.
 - 3) Chem-Masters Corp./Polyweld.
 - 4) Substitutions: Refer to Section 01 25 00.
- D. Gypsum Plaster: Provide materials which result in surfaces matching adjacent existing surfaces, but no less than following.
 1. Basecoat Materials: Provide either neat or ready-mixed (where applicable) materials, complying with ASTM C28.
 - a. Cement: Provide either ready-mixed or neat gypsum plaster conforming to ASTM C28.
 - b. Lime: Normal finishing hydrated lime, ASTM C6.
 - c. Aggregate: Natural sand, conforming to ASTM C35; clean, washed, free from substances detrimental to plaster.
 2. Finishing Materials:
 - a. Cement: Keene's cement conforming to ASTM C61.
 - b. Lime: Special finishing hydrated lime, Type S, ASTM C206.
 - c. Aggregate: Clean white natural sand, conforming to ASTM C35; clean, washed, free from substances detrimental to plaster and capable of providing specified finish.
 3. Gypsum Plaster Bonding Agent: ASTM C631 bonding agent as recommended by manufacturer for gypsum cement applications.
 - a. Manufacturers:
 - 1) Larsen Product Corp./Plaster-Weld.
 - 2) H.B. Fuller/Ful-O-Mite BC-316.
 - 3) Substitutions: Refer to Section 01 25 00.
- E. Molding Plaster: ASTM C59, plaster of Paris.
 1. Moldings and Decorations: Replicate, repair and restore or move existing decorative moldings, applied panels, grooving and cast decorations.
 2. Cast decorative elements from molds prepared from existing decorations; strip and clean existing decorations to produce clean, sharp molds.
- F. Water: Clean, fresh and free from injurious amounts of oil, acid, alkali, salts, minerals, organic matter or other deleterious substances.

- G. Integral Color: Pure, non-fading, mineral oxide color conforming to ASTM C979 and designed and mixed to provide uniform color finish coat.
 - 1. Color: As selected by Architect and as required to produce final color of plaster to match existing plaster; custom color may be required.
- H. Lathing Materials and Accessories: Comply with requirements of referenced ASTM standards and applicable code requirements.
 - 1. Manufacturers:
 - a. ClarkDietrich Building Systems.
 - b. Phillips Manufacturing Co.
 - c. Alabama Metal Industries Corp. (AMICO).
 - d. Keene Products from Metalex, a Division of The Koller Group.
 - e. Delta Star, Inc., Superior Metal Trim.
 - f. Substitutions: Refer to Section 01 25 00.
 - 2. Metal Components:
 - a. Exterior Concealed Components: Hot-dipped galvanized, ASTM A653 minimum G90 for 18 gage and lighter formed metal products, ASTM A123 galvanized after fabrication for 16 gage and heavier products.
 - b. Exterior Exposed Components: Zinc accessories unless fully concealed in plaster.
 - c. Interior Components: Rust-inhibitive paint may be used in lieu of galvanizing other than in areas of potential high humidity.
 - 3. Metal Lath: Self-furring type where over solid substrate.
 - a. Typical: Expanded diamond mesh, minimum 2.5 lbs. per square yard.
 - b. Soffits: Expanded diamond mesh, minimum 3.4 lbs per square yard; provide ribbed lath where spanning between supports.
 - c. Tie Wire: ASTM A641, soft temper, Class 1 zinc coated; minimum 16 gage for tying metal lath to furring channels and metal lath to metal lath.
 - 4. Gypsum Lath: ASTM C37, Type X with core having increased fire-retardant properties; 1/2" thick unless otherwise indicated.
 - 5. Inside Corner Mesh: Minimum 26 gage steel; perforated or expanded flanges or clips shaped to permit complete embedding in plaster; minimum 3" x 3" size.
 - 6. Anchorages: Tie wire, nails, screws and other approved metal supports, of type and size to suit application.

7. Accessories: Provide as required for complete plaster patching, replace components which are damaged; match existing; conform to recommendations of referenced standards.
 - a. Casing Beads and Base Screeds: Minimum 26 gage, square edges at casing beads; provide with expanded flanges.
 - b. Expansion and Control Joints: Match existing.

2.2 PLASTER MIXES

- A. Provide Portland cement plaster mixes in accordance with ASTM C926 as appropriate to substrate indicated and approved samples.
- B. Provide gypsum plaster in accordance with ASTM C842 as appropriate for patching existing interior plaster.
- C. Mix only as much plaster as can be used in one hour.
- D. Mix materials dry, to uniform color and consistency, before adding water.
- E. Protect mixes from frost, dust and evaporation.
- F. Do not retemper mixes after initial set has occurred.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify climatic and surface conditions are satisfactory.
- B. Do not commence installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Preparation of Existing Plaster: Remove deteriorated plaster, cut back to sound plaster and back bevel remaining plaster edges, route cracks to scratch coat and bevel plaster edges.
 1. Apply bonding agent to existing plaster in accordance with bonding agent manufacturer's recommendations.
 - a. Gypsum Plaster: Prepare surfaces for direct bonding of gypsum plaster; conform to ASTM C843 for preparation and application of bonding agent and application of plaster over bonding agent.

2. Remove and replace lathing which is rusted or damaged; remove sufficient plaster to allow firm wire tie bond of new lathing to existing undamaged lathing.
 - a. Metal Lath: Apply metal lath taut, with long dimension perpendicular to supports; secure end laps with tie wire where they occur between supports; lap sides minimum 1-1/2"; secure with tie wires.
 - b. Gypsum Lath: Attach gypsum lath to framing with screws; attach with resilient clips where plaster is part of sound rated partitions.
 3. Where efflorescence or stains are evident, ensure cause of moisture in back-up materials has been eliminated.
- B. Installation of New Metal Accessories: Fasten in place true to line and in correct relation to adjacent materials and as to prevent dislodging and misalignment by subsequent operations. Fasten at both ends and at maximum 12" on center.
1. Bring grounding edge of accessories to true lines, plumb, level, and straight.
 2. Install accessories to provide required depth of plaster and to bring plaster surface to required plane.
 3. Install continuous corner reinforcement for full length of external corners.
 4. Beads: Use single length of metal beads wherever length of run does not exceed longest standard stock length available; miter or cope corners.
 - a. Provide casing beads where plaster abuts dissimilar construction and at perimeter of openings where edges of plaster will not be concealed by other work.

3.3 PATCHING PORTLAND CEMENT PLASTER

- A. Remove surface deposits on plaster with dry brush and wipe affected areas with damp cloth.
- B. General: At major repair areas conform to ASTM C926.
1. Apply cement plaster using three coats unless otherwise required to match existing.
 2. Apply each base coat to minimum thickness of 3/8"; allow each coat to slowly dry for minimum period of 48 hours;
 - a. Moist cure first base coat (scratch coat) during 48 hour period.
 3. Allow base coats to cure for minimum 7 days prior to application of finish coat.
 4. Evenly dampen base coat, to ensure uniform suction, and apply finish coat; apply thickness sufficient to secure required texture but in no case less than 1/8".
 - a. Apply pre-mixed finish coat in accordance with manufacturer's recommendations.

5. Maintain surface flatness, with maximum variation of 1/8" in 10'-0".
 6. Avoid excessive working of surface, delay trowelling as long as possible to avoid drawing excess fines to surface.
 7. Finish: Provide surfaces with finish to match existing.
- C. Repairing Portland Cement Plaster: Repair major and minor damage to cement plaster (stucco).
1. For sound cement plaster, having small cracks or other cosmetic blemishes, clean entire surface of existing plaster with detergent, and rinse with clear water.
 - a. If surface has been painted, remove paint.
 - b. Over one or two coats of sound condition paint, after washing and rinsing surface apply one coat of bonding agent tested and compatible with paint.
 - c. Apply finish coat of Portland cement stucco to thickness of approximately 1/8", and texture as required to match adjacent plaster finish.
 - d. Take special precautions to ensure temperature of material is maintained at 50 degrees F. during, and for not less than, 48 hours after application.
 2. For unsound cement plaster, where segments have become detached from back-up base, remove unsound areas, and verify condition of back-up or base.
 - a. Replace damaged lath or lath without sufficient mechanical bond with new self-furring galvanized metal lath.
 - b. If back-up is concrete or masonry, clean it completely of old cement plaster and apply one coat of bonding agent.
 - c. Apply scratch coat to back-up or base; scratch horizontally for proper bond with brown coat; cure for minimum 48 hours.
 - d. Apply brown and finish coats as required for general Portland cement plaster.
 - e. Texture finish coat as required to match existing.
 3. For large cracks in cement plaster, undercut edges on both sides of cracks to back-up material or base; dry brush cracks clean.
 - a. Apply coat of bonding agent to surfaces of damaged area; mix and apply scratch, brown and finish coats as specified.

3.4 PATCHING GYPSUM PLASTER

- A. Remove surface deposits on plaster with dry brush and wipe affected areas with damp cloth.

- B. General: Apply gypsum plaster in accordance with ASTM C842 and referenced standard; match existing system; apply each base coat to minimum thickness specified in ASTM C842.
 - 1. Allow each coat to slowly dry for minimum period of 48 hours.
 - 2. Allow base coats to cure for minimum 7 days prior to application of finish coat.
 - 3. Evenly dampen base coat, to ensure uniform suction, and apply finish coat; apply thickness sufficient to secure required texture but in no case less than 1/8".
 - 4. Apply finish coat in accordance with ASTM C842.
 - 5. At level areas maintain surface flatness, with maximum variation of 1/8" in 10'-0".
 - a. At curved surfaces maintain true to line within 1/4" in 10'-0".
 - 6. Finish: Provide surfaces with smooth-surface finish to match adjacent surfaces.
 - a. Avoid excessive working of surface, delay trowelling as long as possible to avoid drawing excess fines to surface.
- C. Patching Check-Cracks:
 - 1. Flake out chips from each check-cracked area in severe cases, where finish has broken its bond with basecoats and can be removed easily in dry chips.
 - 2. Bevel edges of sound finish plaster around perimeter of each area and dry brush surfaces to receive new finish plaster patch.
 - 3. Apply bonding agent to existing base-coat plaster, including edges of cut areas, and permit agent to dry in accordance with manufacturer's recommendations.
 - 4. Mix and apply finish coat of patching plaster, press tightly against back-up coat to establish bond.
 - a. Immediately apply additional layer of patching plaster, from same batch, following same procedure, to fill crack to level of undisturbed surround finish coat.
 - 5. When patching plaster has stiffened, remove trowel marks and other surface imperfections with light trowel pressure.
 - 6. In cases where finish is bonded tightly to basecoat, lightly sand affected area with No. 000 cloth, removing raised edges. Wash, rinse and permit to dry.
- D. Patching Large Cracks: Before beginning corrective measures, cut plaster in area of one crack through its entire thickness to backing material.
 - 1. Verify backing material and its general condition.
 - 2. Establish type and thickness of original plaster.

3. Rake and undercut plaster for full thickness making cut sufficiently wide (generally double width of crack) to properly receive patching plaster.
 - a. Drybrush loose plaster from cut.
 - b. Mix and apply basecoats of patching plaster as required to match existing.
 4. Apply finish coats to partially dry basecoat or to thoroughly dry basecoat which has been evenly wetted by brushing or spraying with water.
 - a. Apply finish coat as required to match existing finish and as specified for general plaster.
- E. Minor Repairing to Ornamental Plaster Work: Repair small nicks, gouges, and chips.
1. Dry brush damaged area to remove loose plaster particles; if shape of damaged area is not conducive to good mechanical bond, trim cut edges of area to slight reverse bevel.
 2. Apply bonding agent to damaged area, and permit to dry.
 3. Prepare plaster and apply to damaged area in one operation.
 - a. Shape mixture to surrounding profile, using moistened paper or cloth, to obtain smooth dense finish.
 - b. When plaster is thoroughly dry and cured, perform final shaping with No. 000 grit damp emery cloth.
- F. Major Repairing to Ornamental Plaster Work: Repair major damage to ornamental plaster.
1. Undercut edges of damaged area to back-up material or base.
 2. Apply bonding agent to solid back-up and permit to dry.
 3. Mix and apply scratch and brown coats.
 4. Prepare running and casting molds, as required for condition.
 - a. Use casting molds for additional ornamentation that cannot be run in place.
 - b. Erect supports for molds as each segment of work is performed.
 5. Mix and place plaster to match surrounding ornamental plaster work, over partially dry brown coat or thoroughly dry brown coat which has been dampened by brushing or spraying with water.
 6. Leave molds in position until plaster has cured fully; remove molds carefully to prevent damaging newly molded areas; perform final shaping, if required, with No. 000 grit emery cloth.

3.5 CLEANING

- A. Promptly remove plaster from surfaces not indicated to be plastered.
- B. Repair other surfaces damaged by plaster patching operations to original undamaged condition as approved by Architect.

3.6 PROTECTION

- A. Protect surfaces from stains, marring, and other damage; repair stained, marred and damaged surfaces prior to Substantial Completion.

END OF SECTION

SECTION 09 05 61

COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This section applies to all floors identified in the contract documents as to receive the following types of floor coverings:
 - 1. Resilient tile and sheet.
 - 2. Carpet tile.
 - 3. Thin-set ceramic tile.
- B. Preparation of new concrete floor slabs for installation of floor coverings.
- C. Testing of concrete floor slabs for moisture and alkalinity (pH).

1.02 RELATED REQUIREMENTS

- A. New concrete slab on grade: Moisture emission reducing curing and sealing compound for slabs to receive adhered flooring, to prevent moisture content-related flooring failures; to remain in place, not to be removed. See note on structural drawings for more information.

1.03 REFERENCES

- A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2013.
- B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete; 1999 (Reapproved 2014).
- C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.
- D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2011.

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. 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.
- B. Adhesive Bond and Compatibility Test Report.

1.06 QUALITY ASSURANCE

- A. Contractor may perform adhesive and bond test with his own personnel or hire a testing agency.

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. 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. If testing agency recommends any particular products, use one of those.

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

- A. Perform following operations in the order indicated:
 - 1. Preliminary cleaning.
 - 2. Moisture vapor emission tests; 3 tests in the first 1000 square feet (100 square meters) and one test in each additional 1000 square feet (100 square meters), unless otherwise indicated or required by flooring manufacturer.
 - 3. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
 - 4. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
 - 5. Specified remediation, if required.
 - 6. Patching, smoothing, and leveling, as required.
 - 7. Other preparation specified.

8. Adhesive bond and compatibility test.
9. Protection.
- B. 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 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 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.

3.03 MOISTURE VAPOR EMISSION TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F1869 and as follows.
- D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet (1.4 kg per 93 square meters) per 24 hours.
- F. Report: Report the information required by the test method.

3.04 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.
- C. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.

- D. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch (25 mm) 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.
- 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 alkalinity (pH) test value is over 10.

3.05 PREPARATION

- A. See individual floor covering section(s) for additional requirements.
- B. Comply with requirements and recommendations of floor covering manufacturer.
- C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.
- D. Do not fill expansion joints, isolation joints, or other moving joints.

3.06 ADHESIVE BOND AND COMPATIBILITY TESTING

- A. Comply with requirements and recommendations of floor covering manufacturer.

3.07 APPLICATION OF REMEDIAL FLOOR COATING

- A. Comply with requirements and recommendations of coating manufacturer.

3.08 PROTECTION

- A. Cover prepared floors with building paper or other durable covering.

END OF SECTION

SECTION 09 21 00

GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide gypsum board systems including gypsum board, joint treatment, acoustical accessories, and general accessories for complete installation.
 - 1. Provide special surface texture finish coat.
- B. Related Sections:
 - 1. Section 07 21 00: Building thermal insulation.
 - 2. Section 09 30 00: Cementitious backer unit tile substrates.

1.2 REFERENCES

- A. ASTM C840: Application and Finishing of Gypsum Board.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination,
 - 1. Openings: Obtain dimensions and locations from other trades and provide openings and enclosures for accessories, specialties, equipment, and ductwork.
 - 2. Large Format Tile: Tile Council of North America (TCNA) requires framing at large format tile to be maximum 16" on center and for maximum deflection of L/720 where large format tile as defined by TCNA is indicated.

1.4 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature for framing, insulation, gypsum board, and acoustical accessories.
- B. Samples: Submit samples of special texture finish.
- C. Manufacturer's Certification: Furnish manufacturer's certification indicating products comply with Contract Documents and applicable codes.

1.5 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control for adhesives, sealants, and caulks.
- B. Level 4 Finish Mock-Up: Provide Level 4 finish mock-up not less than 100 square feet in location acceptable to Architect. Approved mock-up may be incorporated into Project.

- C. Level 5 Finish Mock-Up: Provide Level 5 finish mock-up not less than 100 square feet in location acceptable to Architect. Approved mock-up may be incorporated into Project.
- D. Special Textured Finish Mock-Up: Provide special texture finish mock-up not less than 100 square feet in location acceptable to Architect. Approved mock-up may be incorporated into Project.

1.6 PROJECT CONDITIONS

- A. Do not begin installation of interior gypsum board until space is enclosed, space is not exposed to other sources of water, and space is free of standing water.
- B. Maintain areas to receive gypsum board at minimum 50-degree F for 48 hours prior to application and continuously after application until drying of joint compound is complete; comply with ASTM C840.
- C. Immediately remove from site gypsum board for interior use exposed to water, including gypsum board with water stains, with signs of mold, and gypsum board with mildew.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. National Gypsum Co.
- B. Georgia-Pacific Corp.
- C. United States Gypsum Co., USG Corp.
- D. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide gypsum board assemblies including gypsum board, joint treatment, acoustical accessories, and general accessories.
 - 1. Systems Responsibility: Provide products manufactured by or recommended by manufacturer of gypsum board to maintain single-source responsibility for system.
- B. Performance Requirements: Perform gypsum board systems work in accordance with recommendations of ASTM C840 unless otherwise specified.
- C. Regulatory Requirements, Fire-Ratings: Provide systems listed in applicable code or by Underwriter's Laboratory, Gypsum Association (GA) File No's in GA-600 Fire Resistance Design Manual or other listing approved by applicable authorities.
- D. Gypsum Board: Comply with ASTM C840; maximum permissible lengths; ends square cut, tapered edges on boards to be finished.
 - 1. Typical: ASTM C1396, Type X, fire rated gypsum board, unless otherwise indicated.

2. First Layer at Double Layer Applications: ASTM C1396 or ASTM C442, Type X, fire rated gypsum backing board.
3. Mold Resistant Gypsum Board: Provide at high humidity areas not covered with tile including but not limited to kitchens, bathrooms, showers, laundries, and basements.
 - a. USG Industries/Sheetrock Mold Tough Firecode Core.
 - b. Georgia Pacific/ToughRock Mold-Guard Fireguard X.
 - c. National Gypsum Gold Bond XP Fire-Shield Gypsum Board.
 - d. Substitutions: Refer to Section 01 25 00.
4. Tile Substrates: Cementitious backer units specified in Section 09 30 00 - Tiling.
5. Cementitious Backer Units for FRP and Shower/Tub Surrounds: ANSI A118.9 aggregated Portland cement with woven glass-fiber mesh on both faces; approximately 1/2" thick; UL fire rated as required for fire rated assemblies.
 - a. Manufacturers:
 - 1) National Gypsum Co./PermaBase Cement Board.
 - 2) USG Industries, Durabond Division/Durock.
 - 3) Custom Building Products/Wonderboard.
 - 4) James Hardie Building Products/Hardibacker.
 - 5) Substitutions: Refer to Section 01 25 00.
 - b. Contractor Option Coated Glass Mat Backer Units: Georgia Pacific/DenShield, UL fire rated as required to maintain integrity of fire rated assemblies.
6. Standard Gypsum Sheathing: ASTM C1396, Type X, asphalt impregnated core with water resistant surfaces; plain back; square ends, V-tongue and groove long edges.
7. Sheathing: Silicone treated glass mat gypsum sheathing, ASTM C1177, Type X, 5/8" thick unless otherwise indicated.
 - a. Manufacturers:
 - 1) Georgia Pacific/DensGlass Gold.
 - 2) Substitutions: Refer to Section 01 25 00.
8. Veneer Plaster Base: ASTM C588, Type X, veneer plaster base.
9. Exterior Gypsum Soffit Board: ASTM C931, Type X; as recommended by manufacturer for exterior non-exposed applications.
10. Special High Rated STC Walls: Acoustically enhanced gypsum board designed with special layer of damping material sandwiched between two pieces of gypsum board for additional sound damping.
 - a. National Gypsum: Soundbreak Gypsum Board.
 - b. Substitutions: Refer to Section 01 25 00.

11. Abuse Resistant Gypsum Board: Fire rated Type X abuse resistant gypsum board.
 - a. National Gypsum Hi-Abuse Brand Wallboard.
 - b. Georgia Pacific/ToughRock Abuse-Resistant Gypsum Board.
 - c. USG/Sheetrock Abuse-Resistant Gypsum Panels.
 - d. Substitutions: Refer to Section 01 25 00.
12. Extended Exposure Gypsum Board: Fire rated Type X gypsum board designed specifically for extended exposure to moisture during construction; ASTM C1177; provide with score of 10 when tested using ASTM D3273 for mold resistance.
 - a. National Gypsum/eXP Extended Exposure Sheathing.
 - b. Georgia Pacific/DensArmor Plus or DensGlass.
 - c. USG/Sheetrock Fiberock Aqua Tough Sheathing.
 - d. Substitutions: Refer to Section 01 25 00.
13. Fiberglass Mat Faced Gypsum Roof Board:
 - a. USG Securock Glass-Mat Roof Board.
 - b. Georgia-Pacific DensDeck Prime Roof Board.
 - c. Substitutions: Refer to Section 01 25 00.

E. Gypsum Board Accessories: Comply with ASTM C840.

1. Provide protective coated steel corner beads and edge trim; type designed to be concealed in finished construction by tape and joint compound.
2. Corner Beads: Manufacturer's standard metal beads.
3. Edge Trim: "J", "L", "LK", or "LC" casing beads.
4. Reinforcing Tape, Joint Compound, Adhesive, Water, Fasteners: Types recommended by system manufacturer and conforming to ASTM C475.
 - a. Typical Joint Compound: Chemical hardening type for bedding and filling, ready-mixed or powder vinyl type for topping.
5. Control Joints: Back to back casing beads.
 - a. Back control joints with 4 mil thick polyethylene air seal.
6. Reveals: Extruded aluminum special trim pieces in manufacturer's standard or custom shapes to conform to configurations and dimensions indicated.
 - a. Manufactures:
 - 1) Fry Reglet Corp./Drywall Moldings.
 - 2) Gordon Inc./Final Forms I Drywall Trims.
 - 3) Substitutions: Refer to Section 01 25 00.
7. Surface Texture Coat: Provide manufacturer's standard texture finish materials as required to match approved samples and mock-up; materials to have maximum flame spread of 25 and smoke developed of 450, ASTM E84.

- a. Light Sand Finish Texture: Match USG/Texture I, light sand finish texture.
 - b. Orange Peel Texture: Match USG/Texture II, orange peel effect.
 - c. Sand Paste Stipple Texture: Match USG/Textolite Sanded Paste Stipple.
 - d. Light Sand Texture: Match USG/Textone Light Sand Texture.
 - e. Special Pattern Texture: Match USG/Textone Smooth Design Texture for special pattern textures as directed by Architect.
 - f. Ceiling Texture: Match USG/Imperial QT Texture Finish ceiling texture; maximum flame spread of 25.
- F. Acoustical Accessories: Provide as indicated and as required to achieve acoustical ratings indicated.
- 1. Resilient Channels: Provide resilient channels where indicated and where required to provide required sound transmission classifications.
 - a. USG/RC-1.
 - b. ClarkDietrich/RC-Deluxe.
 - c. Substitutions: Refer to Section 01 25 00.
 - 2. Acoustical Insulation: Preformed mineral fiber, ASTM C665, Type I; friction fit type without integral vapor barrier; as required to meet STC ratings indicated, or of thickness indicated.
 - 3. Acoustical Sealant: ASTM C919, type recommended for use in conjunction with gypsum board. Paintable, non-shrinking and non-cracking where exposed, nondrying, nonskinning, nonstaining, and nonbleeding where concealed.
 - a. Acoustical Sealant Manufacturers:
 - 1) USG/Sheetrock Acoustical Sealant.
 - 2) Tremco/Acoustical Sealant.
 - 3) Pecora/AC-20.
 - 4) Substitutions: Refer to Division 1.
 - 4. Electrical Box Pads: Provide at outlet, switch and telephone boxes in walls with acoustical insulation.
 - a. Electrical Box Pad Manufacturers for Non-Fire Rated Partitions:
 - 1) Harry A. Lowry & Associates (800.772.2521)/Lowry's Electrical Box Pads.
 - 2) Tremco Sheet Caulking (650.572.1656).
 - 3) Fire rated partition material manufacturers.
 - 4) Substitutions: Refer to Section 01 25 00.

b. Electrical Box Pad Manufacturers for Fire Rated Partitions:

- 1) Hevi-Duty Nelson (800.331.7325)/Fire Rated FSP Firestop Putty Pads.
- 2) Specified Technologies, Inc. (800.992.1180)/Fire Putty Pads.
- 3) Hilti, Corp./Hilti Box Pads.
- 4) Substitutions: Refer to Section 01 25 00.

G. Fire Rated Assembly Accessories: Provide materials and accessories as required to comply with fire rating requirements of UL, GA or other listing approved by applicable authorities.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Gypsum Board Installation: Install in accordance with ASTM C840 and manufacturer's recommendations.

1. Use screws when fastening gypsum board to furring and to framing.
2. Erect gypsum board with ends and edges occurring over firm bearing.
 - a. Ensure joints of second layer do not occur over joints of first layer in double layer applications.
3. For fire rated systems comply with requirements for fire ratings.
4. Place control joints to be consistent with lines of building spaces and as directed by Architect.
 - a. Provide where system abuts structural elements.
 - b. Provide at dissimilar materials.
 - c. Lengths exceeding 30'-0" in partitions.
 - d. Ceiling areas exceeding 50'-0" or 2500 square feet.
 - e. Wings of "L", "U" and "T" shaped ceilings.
5. Place corner beads at external corners; use longest practical lengths.
6. Place edge trim where gypsum board abuts dissimilar materials.
7. Tape, fill, and sand exposed joints, edges, corners and openings to produce surface ready to receive finishes; feather coats onto adjoining surfaces.
8. Finishing: Comply with Gypsum Association (GA) "Levels of Gypsum Board Finish".
 - a. GA Level 4 (Typical): Provide three-coat finishing and sanding is required for surfaces indicated to be painted; provide flush, smooth joints and surfaces ready for applied paint finishes.
 - b. GA Level 5 (Where Indicated): Provide skim coat of joint compound over entire gypsum board surface over Level 4 three-coat finish to achieve special smooth surface ready for applied paint finishes.

- c. Special Texture Finish Coat: Apply special texture coating over surface indicated to be textured in accordance with manufacturer's recommendations; three-coat finishing not required.
- 9. Remove and replace defective work.

B. Acoustical Accessories Installation:

- 1. Place acoustical insulation tight within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- 2. Place acoustical sealant within partitions in accordance with manufacturer's recommendations; install acoustical sealant at gypsum board perimeter at:
 - a. Metal Framing: One or two beads.
 - b. Base layer and face layer.
 - c. Penetrations of partitions.
- 3. Tolerance: Maximum 1/4" space between gypsum board at floor, ceiling, and penetrations and sealed with acoustical sealant.
- 4. Install electrical box pads with pads molded and pressed on back and all sides of box, closing openings, in accordance with manufacturer's instructions, for complete acoustical barrier.
- 5. Pressurized Chambers: Install drywall assemblies airtight at air shafts, stairs, air plenums and where indicated on Drawings.
 - a. Comply with requirements for HVAC system for air pressure requirements.

END OF SECTION

SECTION 09 24 00

PORTLAND CEMENT PLASTER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Stucco: Provide three-coat Portland cement plaster (stucco) with rainscreen, metal lath, and accessories as required for complete finished system.
2. Base for Surface Bonded Masonry: Provide two-coat Portland cement plaster base for surface bonded thin set veneer systems with metal lath and accessories as required for complete finished system.

B. Related Sections:

1. Section 07 28 00: Weather barrier underlayment.
2. Section 09 01 20: Plaster patching.
3. Section 09 90 00: Painting of stucco.

1.2 REFERENCES

- A. ASTM C926: Application of Portland Cement Based Plaster.**
- B. ASTM C1063: Installation of Lathing and Furring for Portland Cement Plaster.**

1.3 SUBMITTALS

- A. Product Data:** Submit manufacturer's product information for each lathing material and accessory, and for plaster materials.
- B. Shop Drawings:** Indicate locations of control and expansion joints where not shown on Drawings.
- C. Samples:** Furnish 24" by 24" stucco samples using materials and methods specified including lath.

1.4 QUALITY ASSURANCE

- A. Mock-Ups:** Provide not less than 100 sf mock-up of each type of plaster; approved mock-ups may be incorporated into Project.

1.5 SITE CONDITIONS

- A. Take precautionary measures to ensure plaster is not subjected to excessive sun and wind which could cause uneven and excessive evaporation, premature dehydration, or cracking.**
- B. Cold-Weather Requirements:** Do not apply plaster unless minimum ambient temperature of 40 degrees F has been and continues to be maintained for minimum 48 hours prior to application and until plaster is cured.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. System Description: Provide three coat Portland cement plaster (stucco) and two-coat Portland cement plaster base for bonded masonry, with metal lath and accessories.
- B. Regulatory Requirements: Comply with applicable codes.
- C. Portland Cement Plaster: Provide either ready-mixed materials unless otherwise approved in writing by Architect, complying with ASTM C926.
 - 1. Scratch and Brown Coat Materials:
 - a. Cement: Normal Type 1 or 1A Portland cement, ASTM C150.
 - b. Hydrated Lime: Special finishing hydrated lime, Type S, ASTM C206.
 - c. Aggregate: Natural sand, conforming to ASTM C897 or C144.
 - 2. Brown Coat Water Acrylic Admix: Acrylic polymer specifically manufactured for use in Portland Cement Plaster (Stucco) applications and which will not detrimentally affect finish.
 - a. Manufacturers:
 - 1) Larsen Products Corp/Acrylic Admix 101.
 - 2) BASF/Thoro Acryl 60.
 - 3) Chem-Masters Corp/Cretelox.
 - 4) Substitutions: Refer to Section 01 25 00.
 - 3. Finishing Materials: Same as brown coat with acrylic admix with integral color and white cement. Factory premix finish coat is acceptable.
 - a. Provide white cement from a single manufacturer and clear silica sand at applications indicated to have integral color.
 - b. Integral Color: Pure, non-fading, mineral oxide color conforming to ASTM C979 and designed and mixed to provide uniform color finish coat.
 - 1) Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
 - 4. Proprietary Finishing Materials: Provide proprietary Portland cement-based factory mixed integral color finishing materials as indicated and as approved by Architect.
 - a. Manufacturers:
 - 1) La Habra Products, Inc.
 - 2) Merlex Stucco, Inc.
 - 3) Omega Products Corp.
 - 4) Substitutions: Refer to Section 01 25 00.

- b. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
 - 5. Proprietary Finishing Materials: Provide proprietary acrylic based factory mixed integral color finishing materials as indicated and as approved by Architect.
 - a. Manufacturers:
 - 1) Dryvit Systems/Textured Acrylic Finish.
 - 2) Omega Products Corp./Akroflex.
 - 3) La Habra Products, Inc./DPR Acrylic Finish.
 - 4) Senergy, Inc./Acrylic Finish.
 - 5) Sto Corp./Stolit.
 - 6) Substitutions: Refer to Section 01 25 00.
 - b. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
 - 6. Water: Clean, fresh and free from injurious amounts of oil, acid, alkali, organic matter or other deleterious substances.
 - 7. Bonding Agent: Conform to ASTM C932.
 - a. Manufacturers:
 - 1) Larsen Products Corp./Weld-Crete.
 - 2) BASF/Thorobond.
 - 3) Chem-Masters Corp./Polyweld.
 - 4) Substitutions: Refer to Section 01 25 00.
- B. Metal Components: Comply with requirements of ASTM C1063.
 - 1. Manufacturers:
 - a. Phillips Manufacturing Company
 - b. Alabama Metal Industries Corp (AMICO).
 - c. ClarkDietrich Building Systems.
 - d. Substitutions: Refer to Section 01 25 00.
 - 2. Exterior Components: Hot-dip galvanized finish; ASTM A924 and A653 minimum G90 for 18 gage and lighter formed metal products, ASTM A123 galvanized after fabrication for 16 gage and heavier products.
 - a. Exposed Exterior Components: Zinc accessories unless fully concealed in plaster.
 - 3. Suspension System: Size to comply with referenced standards.
 - a. Main Runners: Hot or cold-rolled steel.
 - 1) Main Carrying Channels: Minimum 16 gage, 1-1/2" by 1/2".
 - 2) Furring Channels: Minimum 16 gage, 3/4" by 1/2".

- b. Hangers: Size and type to suit application and to rigidly secure system in place, with maximum deflection of $L/360$.
 - 1) Hanger Wire: ASTM A641, Class 1 galvanized.
 - 2) Hanger Rods and Flats: Mild steel.
 - c. Lateral Bracing: Minimum 16 gage cold-rolled steel.
 - d. Anchorage and Fastening: Approved devices of type and size to suit application and to rigidly secure suspension system.
 - 4. Exterior Metal Lath: Galvanized expanded diamond mesh; minimum 2.5 psy at vertical applications, 3.4 psy at horizontal applications.
 - a. Backing: Weather resistive barrier system specified in Section 07 28 00 – Weather Barrier/Underlayment.
 - b. Self-Furring: Where over solid substrate, provide “V” groove type to hold lath approximately 1/4" from supporting base.
 - c. Tie Wire: ASTM A641, soft temper, Class 1 zinc coated; minimum 16 gage for tying metal lath to furring channels and metal lath to metal lath.
 - 5. Inside Corner Mesh: Minimum 26-gage steel; perforated or expanded flanges or clips shaped to permit complete embedding in plaster; minimum 2" by 2" size.
- C. Accessories: Provide as indicated, as recommended by referenced standards, and as required for complete installation.
 - 1. Manufacturers:
 - a. Keene Products from Metalex, a Division of The Koller Group.
 - b. Delta Star, Inc., Superior Metal Trim.
 - c. Brand X Metals.
 - d. Lath manufacturers.
 - e. Substitutions: Refer to Section 01 25 00.
 - 2. Casing Beads and Base Screeds: Minimum 26-gage, square edges at casing beads, drip type base screeds; provide with expanded flanges.
 - 3. Expansion Joints: Two-piece slip type joints; commonly referred to as No. 40.
 - 4. Control Joints: One-piece metal joint designed to interlock with plaster similar to Keene/XJ15-3.
 - 5. Aluminum Vent Strips and Channel Screeds: Extruded aluminum alloy 6063 and temper T5 or T6, minimum 0.05" thick; with manufacturer's standard baked-on finish.
 - a. Manufacturers:
 - 1) Fry Reglet Corp./Plaster Moldings.
 - 2) Gordon Inc./Final Forms II.
 - 3) Substitutions: Refer to Section 01 25 00.

- b. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
- D. Anchorages: Tie wire, nails, screws and other approved metal supports, of type and size to suit application.
 - 1. Staples not permitted.

2.2 PLASTER MIXES

- A. Provide plaster mixes in accordance with ASTM C926 as appropriate to the substrate indicated and the approved samples.
- B. Mix only as much plaster as can be used in one hour.
- C. Mix materials dry, to uniform color and consistency, before adding water.
- D. Protect mixes from frost, dust and evaporation.
- E. Do not retemper mixes after initial set has occurred.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate suspended work with structural work to ensure inserts and structural anchorage provisions have been installed to receive hangers.
 - 1. Coordinate location of hangers with other work.
- B. Prior to application ensure mechanical and electrical services behind surfaces to receive cement plaster have been tested and approved.
- C. Ensure framing has been properly installed and rigidly secured.

3.2 INSTALLATION

- A. Erect furring and lath in accordance with ASTM C1063.
- B. Install work true to lines and levels and to provide surface flatness with maximum variation of 1/8" in 10'-0" in any direction.
- C. Isolation: Isolate lathing and metal support system where it abuts building structure horizontally, and where partition/wall work abuts overhead structure, to prevent transfer of building loads into plaster.
 - 1. Install slip or cushion type joints to absorb deflections but maintain lateral support.
- D. Frame both sides of expansion joints independently unless otherwise indicated, do not bridge joints with furring and lathing or accessories.

- E. Fixture Support Framing: Install supplementary framing, blocking and bracing where work is indicated to support fixtures, equipment, services and similar work requiring attachment and support.
- F. Coordinate installation of anchors, blocking, electrical and mechanical work which is to be placed in or behind framing; allow such items to be installed after framing is complete.
- G. Install expansion and control joints so plaster areas do not exceed 120 ft², and with area sides having a maximum one to two and a half (1:2-1/2) ratio, unless otherwise approved by Architect.
- H. Suspension System: Install to heights indicated on Drawings.
 - 1. Install independent of walls, columns and overhead work.
 - 2. Use hangers spaced maximum 4'-0" on center.
 - 3. Space main carrying channels maximum 4'-0" on center and not more than 6" from perimeter walls; lap splices minimum 12" and secure together 2" from each end of splice.
 - 4. Securely fix carrying channels to hangers to prevent turning or twisting and to develop full strength of hangers.
 - 5. Place furring channels perpendicular to carrying channels, not more than 2" from perimeter walls; rigidly secure to carrying channels.
 - 6. Lap splices minimum 8" and secure together 1" from each end of splice.
 - 7. Reinforce openings in suspension system which interrupt main carrying channels or furring channels, with lateral channel bracing; extend bracing minimum 24" past openings.
 - 8. Laterally brace suspension system as required to resist seismic loads, including uplift.
- I. Metal Lathing: Apply lath taut, with long dimension perpendicular to supports; secure end laps with tie wire where they occur between supports; lap ends minimum 1" and sides 1/2"; secure with tie wires.
 - 1. Continuously reinforce internal angles.
 - 2. Place 6" wide x 12" long strips of metal lath diagonally at corners of openings; secure rigidly in place.
 - 3. Place 6" wide strips of metal lath at junctions of dissimilar materials; place parallel with dissimilar materials; secure rigidly in place.
- J. Installation of Metal Accessories:
 - 1. Fasten in place true to line and in correct relation to adjacent materials and as required to prevent dislodging and misalignment by subsequent operations.
 - 2. Fasten at both ends and at maximum 12" on center along sides.

3. Bring grounding edge of accessories to true lines, plumb, level, and straight.
4. Install accessories to provide required depth of plaster and to bring plaster surface to required plane.
5. Install continuous corner reinforcement for full length of external corners.
6. Install sill and drip screeds with paper sheathing and lath installed over attachment flange of screeds.
7. Beads: Use single length of metal beads wherever length of run does not exceed longest standard stock length available; miter or cope corners.
 - a. Provide casing beads where plaster abuts dissimilar construction and at perimeter of openings where edges of plaster will not be concealed by other work.

K. Portland Cement Plaster: Conform to ASTM C926.

1. Stucco: Apply three coat cement plaster system, scratch, brown, and finish coats.
2. Base for Surface Bonded Masonry: Apply two coat cement plaster system, scratch and brown coats.
3. Apply each base coat (scratch and brown) to minimum thickness of 3/8"; allow each coat to moist cure for minimum period of 48 hours;
 - a. Moist cure first base coat (scratch coat) during 48-hour period.
4. Allow base coats to cure for minimum 7 days prior to application of finish coat.
5. Evenly dampen base coat, to ensure uniform suction, and apply finish coat; apply thickness sufficient to secure required texture but in no case less than 1/8".
 - a. Apply pre-mixed finish coat in accordance with manufacturer's recommendations.
6. Maintain surface flatness, with maximum variation of 1/8" in 10'-0".
7. Avoid excessive working of surface, delay troweling to avoid drawing excess fines to surface.

L. Finish: Provide surfaces with finish to match approved sample panel and mock-up.

3.3 CUTTING AND PATCHING

- A. Cut, patch, point, and repair plaster as necessary to accommodate other work and to restore cracks, dents, and imperfections.
- B. Repair or replace work to eliminate blisters, buckles, crazing, check cracking, dry-outs, efflorescence, sweat-outs, and similar defects.
- C. Finish cutting and patching to match undamaged plaster; patching shall not be visible in finished installation.

3.4 CLEANING

- A. Promptly remove plaster from surfaces not indicated to be plastered.
- B. Repair surfaces stained, marred or otherwise damaged during plastering.

END OF SECTION

SECTION 09 30 00

TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide tile installations with accessories, as required for complete installation.

1. Provide waterproofing membrane integral with tile setting beds.
2. Provide shower pans integral with tile systems.
3. Provide acoustic (sound deadening) underlayment at tile.
4. Provide cementitious backer unit tile substrate.
5. Provide stone thresholds.
6. Provide epoxy thin set tile at elevator floors.

B. Related Sections:

1. Section 09 21 00: Metal framing and gypsum board.
2. Section 09 30 90: Exterior large format tiling.

1.2 REFERENCES

- A. ANSI A108.1: Installation of Tile with Portland Cement Mortar.
- B. ANSI A108.5: Installation of Tile with Latex-Portland Cement Mortar.
- C. ANSI A108.6: Installation of Tile with Chemical Resistant Water Cleanable Tile Setting and Grouting Epoxy.
- D. ANSI A108.10: Installation of Grout in Tilework.
- E. ANSI A108.11: Interior Installation of Cementitious Backer Units.
- F. Tile Council of North America (TCNA): Handbook for Ceramic Tile Installation.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination, Large Format Tile and Framing: Tile Council of North America (TCNA) requires framing at large format tile to be maximum 16" on center and for maximum deflection of L/720 where large format tile as defined by TCNA is indicated.
1. Coordinate with framing installation to ensure proper stud spacing and deflection limits are provided at locations where large format tile is indicated.

1.4 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature for each type of material for Project.

- B. Samples: Furnish each type of tile clearly indicating pattern, coloration and joints.
 - 1. Color Charts: Submit actual tile sections showing full range of colors, textures and patterns available for each type of tile.
 - 2. Prepare two 12" square sample panels of each selected type of tile and grout.

1.5 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control for adhesives, sealants, and caulks.

1.6 SITE CONDITIONS

- A. Provide heat and ventilation in areas where ceramic tile work is being performed, to allow tile to properly set.
- B. Take precautionary measures necessary to ensure excessive temperature changes do not occur.

1.7 WARRANTY

- A. Extended Correction Period: Provide for correcting failure of system to resist water penetration except where failure is result of structural failure of building. Repair system and pay for or replace damaged materials and surfaces.
 - 1. Hairline cracking due to temperature or shrinkage is not considered structural failure.
 - 2. Period: Two years.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. System Description: Provide tile installations with tile, grout, setting materials, and accessories as indicated.
- B. Regulatory Requirements, General:
 - 1. Interior Adhered Veneer: Comply with applicable California Code requirements for interior adhered veneer; maximum 20-psf.
 - 2. Exterior Adhered Porcelain Veneer: Comply with applicable California Code requirements for exterior adhered veneer; maximum 9-psf, 5/8" thick, 24" in any face dimension, nor more than 3-sf in total face area.
- C. Regulatory Requirements, Slip-Resistance:
 - 1. Slip-Resistant Hard Surfaces: Hard surface finishes to comply with requirements of authorities having jurisdiction for slip-resistant hard surfaces, including general code requirements and requirements for access for persons with disabilities.

- D. Tile: Types as indicated which could include ceramic, ceramic mosaic, quarry, paver, porcelain, stone, and glass type tiles.
1. Manufacturers:
 - a. Dal-Tile Corp.
 - b. Crossville Tile.
 - c. Summitville Tiles, Inc.
 - d. Manufacturers listed on Finish Schedule.
 - e. Substitutions: Refer to Section 01 25 00.
 2. Color, Style and Pattern: As indicated on Finish Schedule, as selected by Architect from manufacturer's full range of types of tiles indicated where not otherwise indicated
 - a. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
 3. Base and Trim: Provide matching trim pieces, coordinated with sizes and coursing of adjoining flat tile as directed by Architect; types as indicated, as selected by Architect where not indicated.
- E. Portland Cement Setting Bed: Portland cement bed conforming to ANSI A108.1 and TCNA recommendations including separator sheet and reinforcing mesh.
1. Separator sheet may be deleted where over waterproof membrane.
 2. Separator sheet may be deleted where over waterproof membrane or shower pan.
- F. Latex Thin Set: Thinset bond coat, consisting of latex-cementitious mortar conforming to ANSI A118.4.
1. Manufacturers:
 - a. Laticrete International Inc.
 - b. Bostik Construction Products/Hydroment.
 - c. Custom Building Products.
 - d. Mapei Corp.
 - e. Parex USA/Mer-Krete.
 - f. Substitutions: Refer to Section 01 25 00.
- G. Latex-Cement Grout: ANSI A118.7, latex-cementitious type, uniform in color, resistant to shrinkage.
1. Manufacturers:
 - a. Laticrete International Inc.
 - b. Bostik Construction Products/Hydroment.
 - c. Custom Building Products.
 - d. Mapei Corp.
 - e. Parex USA/Mer-Krete.
 - f. Substitutions: Refer to Section 01 25 00.

2. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
- H. Epoxy Mortar and Grout: Chemical resistant and water cleanable thinset epoxy mortar and grout conforming to ANSI A118.3.
1. Manufacturers:
 - a. Laticrete International Inc.
 - b. Bostik Construction Products/Hydroment.
 - c. Custom Building Products.
 - d. Mapei Corp.
 - e. Parex USA/Mer-Krete.
 - f. Substitutions: Refer to Section 01 25 00.
 2. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
- I. Waterproofing and Crack Isolation Membrane: Manufacturer's standard liquid rubber polymer designed specifically for application under tile in non-immersed applications.
1. Manufacturers:
 - a. Laticrete International Inc./9235 Waterproof Membrane.
 - b. Bostik Construction Products/Hydroment Ultra-Set.
 - c. Custom Building Products/RedGard Membrane.
 - d. Mapei Corp/Mapelastic Aqua Defense.
 - e. Parex USA/Mer-Krete Hydro-Guard 2000.
 - f. Substitutions: Refer to Section 01 25 00.
- J. Shower Pan Liner: Manufacturer's standard sheet membrane designed specifically for application under bed set tile in showers.
1. Manufacturers:
 - a. Parex USA/Mer-Krete BFP Membrane.
 - b. The Nobel Company/Chloraloy.
 - c. Compotite Corp./Composeal Gold or Blue.
 - d. Substitutions: Refer to Section 01 25 00.
- K. Acoustic (Sound Deadening) Underlayment: Manufacturer's standard sound deadening underlayment designed specifically for application under tile with minimum Impact Insulation Class of 50 and STC of 52; nominal 3/8" to 1/ 2" thick.
1. Manufactures:
 - a. Laticrete International Inc./Laticrete 170 or 125 TRI Max Underlayment.
 - b. Custom Building Products/EasyMat Sound Control Application.
 - c. Mapei Corp./Mapesonic 2 or Mapesonic RM.
 - d. Substitutions: Refer to Section 01 25 00.

- L. Cementitious Backer Units: ANSI A118.9 aggregated Portland cement with woven glass-fiber mesh on both faces; approximately 1/2" thick; UL fire rated as required to maintain integrity of fire rated assemblies.
 - 1. Manufacturers:
 - a. USG Industries, Durabond Division/Durock.
 - b. National Gypsum Co./PermaBase Cement Board.
 - c. Custom Building Products/Wonderboard.
 - d. Substitutions: Refer to Section 01 25 00.
 - 2. Contractor Option Coated Glass Mat Backer Units: Georgia Pacific/DenShield, UL fire rated as required to maintain integrity of fire rated assemblies.
- M. Cleaning and Sealing Materials: As recommended by tile and grout manufacturers, such as Bostik Construction Products/Hydroment CeramaSeal.
- N. Floor Sealer (Under Epoxy Set Floors over Concrete): Curing hardener sealer vapor retarder to prevent bond failure of flooring systems, type as recommended by epoxy setting bed material manufacturer for specific applications indicated.
- A. Stone Thresholds: As indicated on Finish Schedules, minimum ASTM C503, Grade A marble where not indicated, sides beveled 1:2 slope; color matching Architect approved sample.
 - 1. Total height of threshold shall not exceed tile or adjacent flooring by more than 1/2"; maximum 1/4" vertical lift and maximum 1:2 slope.
- B. Special Tile Trim Pieces: Provide as indicated on Drawings.
 - 1. Manufacturers:
 - a. Schluter Systems L.P.
 - b. Substitutions: Refer to Section 01 25 00.

2.2 MIXES

- A. Mix and proportion cementitious materials for site-made leveling coats, setting beds and grout as recommended by the TCNA Handbook for Ceramic Tile Installation.
- B. Mix and proportion pre-mixed setting beds and grout materials in accordance with manufacturer's recommendations.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prior to installing tile, ensure surfaces are level; comply with TCNA and tile manufacturer recommendations but not greater than following.
 - 1. Bed Set Tile Tolerance: Maximum surface variation of 1/4" in 10'-0".
 - 2. Thin Set Tile Tolerance: Maximum surface variation of 1/8" in 10'-0".

- B. Ensure surfaces are clean and well cured.
 - 1. Drains: Where indicated, ensure surfaces are properly sloped to drains.
- C. Do not commence work until surface conditions are within tolerances required for proper installation; apply latex leveling material where necessary to meet required tolerances.
- D. Waterproof and Crack Isolation Membrane: Install waterproof membrane at tile areas located above grade, in accordance with manufacturer's recommendations; extend membrane minimum 6" up walls.
 - 1. Comply with waterproof membrane manufacturer recommendations for installation of tile over waterproof membrane.
- E. Showers: Install shower pan liners and wall waterproofing at showers in accordance with manufacturer's recommendations; extend pan liners minimum 6" up walls, waterproofing full height at showers.
 - 1. Comply with manufacturer recommendations for installation of tile over shower pan liner and waterproof membrane.
- F. Acoustic (Sound Deadening) Underlayment: Install acoustic underlayment system where indicated in accordance with manufacturer's recommendations and installation instructions to achieve maximum possible IIC and STC ratings.
 - 1. Comply with manufacturer recommendations for installation of tile over acoustic underlayment system.
- G. Backer Units: Install units in accordance with ANSI A108.11, manufacturer's recommendations, and as required to provide fire ratings indicated on Drawings.
- H. Floor Sealer: Apply vapor retarding floor sealer on concrete floors indicated to receive epoxy set tile in accordance with manufacturer recommendations and installation instructions.

3.2 INSTALLATION

- A. Install tile in accordance with referenced ANSI Standards and TCNA recommendations for type of substrate and indicated setting method.
 - 1. Complexity of TCNA variations in types of tile installation systems and potential for changes to surrounding conditions during design and construction makes exact listing of potential conditions improbable.
 - 2. Contractor, installers, and manufacturer representatives shall inform Architect where actual conditions are not covered and where providing similar materials and systems do not comply with TCNA or manufacturer recommendations.
 - a. Where specified or similar materials and systems do not comply with TCNA or manufacturer recommendations submit proposed substitutions along with statement substitutions are of comparable quality to specified materials.

- B. Following systems shall form the basis of tile installation systems required for Project. Where Project conditions vary from TCNA and manufacturer recommendations, notify Architect immediately. Where different use similar materials and systems as appropriate.
1. Bed Set Floors over Concrete: TCNA F111, with latex cement bond coat.
 2. Bed Set Floors over Wood: TCNA F141, with latex cement bond coat.
 3. Bed Set Floors over Waterproof and Crack Isolation Membrane over Concrete: TCNA F121, with latex cement bond coat.
 4. Bed Set Floors over Waterproof and Crack Isolation Membrane over Wood: TCNA F141, with latex cement bond coat.
 5. Latex-Cement Thin Set Floors over Concrete: TCNA F113.
 6. Latex-Cement Thin Set Floors over Waterproof and Crack Isolation Membrane: TCNA F122.
 7. Latex-Cement Thin Set Floors over Acoustic Underlayment: TCNA F122.
 8. Latex-Cement Thin Set Floors over Cementitious Backer Unit over Wood: TCNA F144.
 9. Latex-Cement Thin Set Wall Tile over Cementitious Backer Units: TCNA W244.
 10. Latex-Cement Thin Set Wall Tile over Coated Glass Mat Backer Units: TCNA W245.
 11. Epoxy Thin Set (Elevator Floors): TCNA F143, with epoxy grout.
 12. Epoxy Thin Set over Concrete (Food Preparation Areas): TCNA F131 with epoxy grout.
 13. Epoxy Thin Set over Cement Mortar: TCNA F114 with epoxy grout.
 14. Showers: TCNA B415 latex bond coat over reinforced mortar bed floor with latex cement thin set over cementitious backer unit walls, with shower pan liners and waterproofing at walls.
 15. Countertops: TCNA C513 latex cement thin set over cementitious backer units.
 16. Countertops: TCNA C512 epoxy thin set over plywood.
 17. Countertops: TCNA C511 latex bond coat over reinforced mortar bed.
- C. Place tile in accordance with patterns indicated on Drawings or as directed by Architect; carefully plan tile layouts, ensure pattern is uninterrupted from one surface to the next and through doorways.
1. Apply latex thin set to back of tile where necessary to ensure 100% bond between bond coat and substrate; replace tiles which break due to voids between tile and substrate.

- D. Place stone thresholds level and true to line; in correct alignment with tile, doors and partitions.
 - E. Neatly cut tile around fixtures and drains; accurately form corners, base, intersections and returns.
 - 1. Base, Coves: Flush cove type with base grout joint on wall, cove tile on floor, unless otherwise indicated.
 - 2. Corners and Edges: Bullnose tile unless otherwise indicated.
 - F. Locate expansion joints, control joints, contraction joints, and isolation joints where indicated; where not indicated, provide as recommended by TCNA Handbook and as approved by Architect.
 - 1. Install special trim pieces as indicated on Drawings and in accordance with manufacturer recommendations and installation instructions, true to lines and levels indicated and in correct relationship with tile and adjacent materials.
 - G. Ensure tile joints are uniform in width, subject to normal variance in tolerance allowed in tile size; ensure joints are watertight, without voids, cracks, excess mortar or grout.
 - H. Sound tile after setting, remove and replace hollow sounding units.
 - I. Allow tile to set for a minimum 48 hours prior to grouting.
 - J. Grout tile to comply with recommendations of TCNA and as specified.
 - K. Leave completed installation free of broken, damaged and faulty tile.
- 3.2 CLEANING AND SEALING
- A. Clean tile surfaces free of foreign matter upon completion of grouting.
 - B. Seal tile and grout surfaces where recommended by manufacturer for materials and applications involved; comply with manufacturer's recommendations.

END OF SECTION

SECTION 09 51 10

ADHERED ACOUSTICAL TILE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide adhesive applied acoustical tile ceiling system with metal trim and accessories as required for complete finished installation.
- B. Related Sections:
 - 1. Section 09 21 00: Gypsum board assemblies.
 - 2. Divisions 21 through 28: Facilities services for ceiling penetrations.

1.2 SUBMITTALS

- A. Product Data: Furnish manufacturers' literature.
- B. Shop Drawings: Clearly indicate tile layout and related dimensioning, junctions with other work and ceiling finishes, and inter-relation of mechanical and electrical items related to system.
- C. Samples: Furnish samples of each type of ceiling unit and exposed trim.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Firm with minimum five years successful experience in projects of similar type and scope; acceptable to manufacturer of acoustical units.

1.4 SITE CONDITIONS

- A. Do not install ceilings until building is enclosed, sufficient heat is provided, dust generating activities have terminated and overhead mechanical work is completed, tested and approved.
 - 1. Do not allow acoustical ceiling units to be exposed to moisture; immediately remove acoustical ceiling units with stains, units with signs of mold, and units with mildew.
- B. Allow wet work to dry prior to commencement of installation.
- C. Maintain uniform temperatures of minimum 60 degrees F and humidity of 20% to 40% prior to, during and after installation.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Armstrong World Industries, Inc.
- B. CertainTeed.

- C. Rockfon North America, Chicago Metallic Corp.
- D. USG Corporation.
- E. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide adhesive applied acoustical tile ceiling system with metal trim and accessories as required for complete finished installation.
- B. Regulatory Requirements:
 - 1. Fire Performance Characteristics: Provide products listed by Underwriters Laboratories (UL) or other independent testing laboratory acceptable to applicable authorities.
 - a. Flame Spread/Smoke Density: Provide products meeting code requirements for maximum 25 flame spread and maximum 450 smoke developed.
- C. Acoustical Tiles: ASTM E1264 type and form as indicated.
 - 1. Tiles: Mineral composition ceiling tiles with beveled edge.
 - 2. Texture: Light fissured panels.
 - 3. Size: 12" by 12", except where otherwise indicated on Drawings.
 - 4. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
- D. Accessories:
 - 1. Adhesive and Splines: Acoustical tile adhesive recommended by tile manufacturer and approved by California State Fire Marshal; with metal or plastic splines.
 - 2. Exposed Metal Trim: Manufacturer's standard channel molding for edges and penetrations of ceiling, with single flange of molding exposed; white to match tile color.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Inspect surfaces to receive tile and remove dust and soil prior to beginning tile installation.
- B. Measure ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling; do not use less than half width units at borders.
- C. Coordinate with other work supported by or penetrating through ceilings, including light fixtures, HVAC equipment and partition systems.

3.2 INSTALLATION

- A. Install acoustical tile ceilings in accordance with manufacturer recommendations and installation instructions for adhered installation directly to substrate.
- B. Adhere tile with minimum four spots of adhesive for each full tile unit and no less than two spots for partial units.
- C. Fit acoustic units in place, free from damaged edges or defects detrimental to appearance and function.
 - 1. Fit border units neatly against abutting surfaces.
- D. Install units free from twist, warp and dents.
- E. Joints: Tight and flush, in accurate alignment; use splines to maintain finished surface flat.
- F. Finished Ceiling Tiles: True to lines and levels and free from warped, soiled or damaged trim or acoustical units.
- G. Install edge moldings at intersection of ceiling and vertical surfaces, using maximum lengths, straight, true to line and level; miter corners.
 - 1. Provide edge moldings at junctions with other ceiling finishes.
- H. Replace any part which is damaged and any part which is faulty.

END OF SECTION

SECTION 09 65 10

RESILIENT BASE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide resilient base and accessories as required for complete finished installation.
- B. Related Sections:
 - 1. Section 09 65 20: Resilient Tile Flooring

1.2 SUBMITTALS

- A. Product Data: Furnish manufacturer's product literature.
- B. Samples: Furnish samples of each base color and type.

1.3 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control for adhesives and resilient flooring.

1.4 SITE CONDITIONS

- A. Comply with manufacturer recommendations for site conditions but not less than following; maintain minimum 70-degree F air temperature at installation area for three days prior to, during, and for 24 hours after installation.
- B. Store materials in area of application; allow three days for material to reach same temperature as area.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Johnsonite, Inc.
- B. Burke Flooring, Division of Burke Industries.
- C. Roppe Rubber Corporation.
- D. Armstrong World Industries.
- E. Flexco Co.
- F. Allstate Rubber Corp.
- G. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide resilient base and accessories as required for complete finished installation.
- B. Performance Requirements: Provide materials tested under ASTM E648, Flooring Radiant Panel Test, with results of 0.45 watts/sq. cm or higher.
- C. Resilient Base: Conform to ASTM F1861, with premolded end stops and external corners; 1/8" gage; provide coved base at hard floor surfaces, straight base at carpet unless otherwise indicated.

BELOW MOLDED RUBBER BASE LIMITED TO 4'-0" LENGTHS; MORE CUSTOM COLORS AVAILABLE AND COLOR MATCHING IS BETTER. 4'-0" LENGTHS ALSO MINIMIZE SHRINKAGE GAPS FROM OPENING BETWEEN BASE SECTIONS.

- 1. Type: Molded rubber, available in 4' lengths.
 - 2. Type: Extruded rubber, in rolls.
 - 3. Type: Vinyl base.
 - 4. Height: 4" unless otherwise indicated.
 - 5. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
- D. Primers and Adhesives: Water-resistant nontoxic types recommended by base manufacturer for specified material and application.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Apply to walls, columns, pilasters, casework, and other permanent fixtures in rooms and areas where base is required.
 - 1. Fit base joints tight and vertical.
 - 2. Maintain minimum measurement of 18" between joints.
- B. Miter internal corners; use molded sections for external corners and exposed ends.
- C. Install base on solid backing, adhere tightly to wall and floor surfaces; fill voids along top edge of base with manufacturer's recommended adhesive filler.
- D. Scribe and fit to door frames and other obstructions.
- E. Install straight and level to variation of plus or minus 1/8" over 10'-0".

3.2 CLEAN-UP

- A. Remove excess adhesive from floor, base and wall surfaces without causing damage.

- B. Clean surfaces in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 09 65 20

RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide resilient tile flooring and accessories as required for complete finished installation.
- B. Related Sections:
 - 1. Section 09 65 10: Resilient base.

1.2 SUBMITTALS

- A. Product Data: Furnish manufacturer's product literature.
- B. Samples: Furnish samples of each type of flooring color and pattern.

1.3 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control for adhesives and resilient flooring.

1.4 SITE CONDITIONS

- A. Ensure floor surfaces are smooth and flat with maximum variation of 1/8" in 10'-0".
- B. Ensure concrete floors are dry and exhibit negative alkalinity, carbonizing, and dusting.
- C. Maintain minimum 70-degree F air temperature at flooring installation area for three days prior to, during, and for 24 hours after installation.
- D. Store flooring materials in area of application; allow three days for material to reach same temperature as area.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Armstrong World Industries, Inc.
- B. Congoleum Corp.
- C. Tarkett Inc./Azrock.
- D. Armstrong World Industries.
- E. Tarkett Inc./Azrock.

- F. Flexco Flooring.
- G. Burke Mercer.
- H. Johnsonite, Inc.
- I. Flexco Flooring.
- J. Freudenberg Building Systems, Inc. (NORA).
- K. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide resilient tile flooring and accessories.
- B. Regulatory Requirements, Flammability: Provide materials tested under ASTM E648, Flooring Radiant Panel Test, with results of 0.45 watts/sq cm or higher.
- C. Regulatory Requirements, Slip-Resistance:
 - 1. Slip-Resistant Hard Surfaces: Hard surface finishes to comply with requirements of authorities having jurisdiction for slip-resistant hard surfaces, including general code requirements and requirements for access for persons with disabilities.
- D. Vinyl Composition Tile (VCT): 12" by 12" by 1/8" thick; vinyl composition tile conforming to ASTM F1066, Composition 1.
 - 1. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
- E. Resilient Luxury Solid Vinyl Tile: 12" by 12" by 1/8" thick; solid vinyl tile conforming to ASTM F1700.
 - 1. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
- F. Resilient Rubber Tile: 12" by 12" by 1/8" thick; solid vinyl tile conforming to ASTM F1344, Class 1B.
 - 1. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
- G. Edge Strips: Homogeneous vinyl or rubber, tapered or bullnose edge, color as selected by Architect.
- H. Sub-Floor Filler: White premixed latex-cement paste designed for providing thin solid surface for leveling and minor ramping of subsurface to adjacent floor finishes.
 - 1. Use material capable of being applied and feathered out to adjacent floor without spalling.

- I. Primers and Adhesives: Waterproof nontoxic types as recommended by flooring manufacturer for specified material and application.
- J. Sealer and Wax: Type recommended by flooring manufacturer for material type and location.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Conform to manufacturer's recommendations for preparation and to ASTM F710.
- B. Remove sub-floor ridges and bumps; fill low spots, cracks, joints, holes and defects with sub-floor filler.
- C. Clean floor and apply, trowel and float filler to leave smooth, flat hard surface; prohibit traffic until filler is cured.
- D. Test substrate for moisture content in accordance with flooring manufacturer recommendations; where moisture content exceeds recommendations take measures recommended by flooring manufacturer.

3.2 INSTALLATION

- A. Conform to manufacturer recommendations and installation instructions.
 - 1. Open floor tile cartons, enough to cover each area, and mix tile to ensure shade variations do not occur within any one area.
- B. Spread cement evenly in quantity recommended by manufacturer to ensure adhesion over entire area of installation; spread only enough adhesive to permit installation of flooring before initial set.
- C. Set flooring in place using methods to ensure full adhesion.
- D. Lay flooring with joints parallel to building lines to produce symmetrical pattern.
- E. Install minimum 1/2 tile at room and area perimeter.
- F. Terminate resilient flooring at centerline of door openings where adjacent floor finish is dissimilar.
- G. Install edge strips at unprotected and exposed edges.
- H. Scribe flooring to walls, columns, floor outlets and other appurtenances, to produce tight joints.
- I. Consult with Architect for floor pattern desired in each area.
- J. Edge Strips: Install where edge of tile would otherwise be exposed; butt to flooring without gaps; set in adhesive.

3.3 CLEAN-UP AND PROTECTION

- A. Remove excess adhesive from floor, base and wall surfaces without causing damage.
- B. Clean, seal and wax floor surfaces in accordance with manufacturer's recommendations.
- C. Prohibit traffic from floor for 48 hours after installation.

END OF SECTION

SECTION 09 77 20

FABRIC WRAPPED PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide fabric wrapped tackboard panels including attachment devices and accessories as required for complete finished installation.

1.2 RELATED SECTIONS:

- 1. Section 06 10 00: Rough Carpentry
- 2. Section 09 21 00: Gypsum Board Assemblies

1.3 REFERENCES

- A. ASTM C208 - Insulation Board (cellulose fiber)
- B. ASTM C557 - Adhesive for Fastening to Wood Framing.
- C. ASTM E84 - Test Method of Surface Burning Characteristics of Building Materials.
- D. ASTM D-1308 - Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
- E. UL - Underwriters Laboratories, Inc.

1.4 QUALITY ASSURANCE

- A. Applicator: Company specializing in tackable Wallboard work with ten years documented experience.
- B. Stain Resistance: ASTM D1308, spot test open; shall show no staining by reagents when cleaned using soap and water.

1.5 REGULATORY REQUIREMENTS

- A. All components of the tackable wallboard system shall Conform to
 - 1. Flame spread and smoke developed ratings of no more than 25/450 (Class A) when tested in accordance with ASTM E84 by UL.
 - 2. CHPS Requirements: – Provide Low Emitting Materials per requirements of Criteria EQ 7.0
 - 3. CALGreen- Provide materials with Low VOC content per CALGreen 5.504.4.

1.6 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Provide product data on wall covering or fabric and fiberboard substrate.

- C. Submit samples under provisions of Section 01 33 00.
- D. Submit full range of manufacturers color selection for wallcovering specified.
- E. Submit test reports verifying flame/smoke ratings and CALgreen compliant VOC limits..

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and protect products to site under provisions of Section 01 66 00.
- B. Deliver tackable wallboard panels to site in unbroken and undamaged factory wrappings, clearly labeled with manufacturers lot number.
- C. Protect tackable wallboard panels from moisture during shipment, storage, and installation.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Do not begin installation of tackable wall board system until spaces have been enclosed and are ventilated and heated to maintain substrate surface temperature.
- B. Maintain constant temperature of no less than 60 degrees F and humidity level of 30 to 50 percent 72 hours prior to, during and after installation of the work of this section. Coordinate any other pre-installation requirements with manufacturer.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - TACKABLE WALLBOARD SYSTEM

- 1. System Description: Provide fabric/wall covering wrapped tackboard panels including concealed mechanical attachments and other accessories as required for complete installation of system in locations as indication on architectural drawings.
- 2. Panels:
 - a. Size: Provide standard manufacturer's sizes. Coordinate dimensions with Architectural drawings.
 - b. Substrate/Core: Provide high-performance, ultra-tackable fiberboard substrate/core with up to 95% recycled content, ironed and prime coated, ASTM C208, soft-textured, cellulosic, 1/2 inch thick min, 4 foot wide x required length, square edges, 16 lb/cu ft density made with binder containing no urea formaldehyde; required flame spread and smoke developed rating.
 - c. Manufacturers:
 - 1) Chatfield-Clark Co. (Basis of Design)
 - 2) Claridge Products and Equipment.
 - 3) Fabricmate.
 - 4) Homasote.

- 5) BP Smartcore.
- 6) Substitutions: Under provisions of Section 01 25 13.

2.2 ACCEPTABLE MANUFACTURERS – NON-VINYL WALLCOVERING

- A. System Description: Provide non-vinyl, self-healing, washable wallcovering/fabric for tackable wallboard system.
 - B. Manufacturers:
 - 1. Maharam- Tek-Wall Tush 001 Angora
- Substitutions: Under provisions of Section 01 25 13

2.3 ACCESSORIES

- A. Wallcovering Adhesive: Manufacturer's standard for use with specified wallcovering and substrate application. Mildew-resistant, non-staining, and strippable. Shall meet South Coast Air Quality Management District (SCAQMD) Rule #1168 and 2022 CALgreen requirements.
- B. Panel Attachment
 - 1. Mechanically fasten panels with concealed fasteners, galvanized z-clips or impaling clips. Basis of Design)
 - 2. Adhere panels to wall per ASTM C557.
- C. Trim: Clear anodized, aluminum "J" molding at bottom, aluminum "L" molding at top and where indicated. All other edges fabric/ wall covering wrapped.
- D. Substitutions: Under provisions of Section 01 25 13.

PART 3 - EXECUTION

3.1 FABRICATION

- A. Machine apply wallcovering continuous over length of fiberboard sheet.
- B. Wrap continuous around edges. Return a minimum of 2 inches on back of panel.
- C. No seams permitted on individual panels.
- D. Field application of wall covering is not permitted.
- E. Laminate wall covering in numbered sequence of covering.
- F. Laminate wall covering to core free from bubbles, sags, wrinkles, distortion and free of adhesive.

3.2 INSPECTION

- A. Verify that site conditions are ready to receive work and opening dimensions are as indicated on shop drawings.
- B. Insure backing materials are firmly attached, free from warps and surface defects and ready to receive individual panels.
- C. Beginning of installation means acceptance of substrate.

3.3 INSTALLATION

- A. Erect fiberboard in vertical direction. Install in full length sections with no horizontal joints.
- B. Install panels beginning at center point of wall and working to room corners.
- C. Install panels in order of sequence of wall covering.
- D. Install panels with vertical surfaces and edges plumb, top edges level and in alignment with other panels.
- E. Install panels butted tight to adjacent materials; casework, chair rail, door frames, ceilings, floors, and soffits as indicated on the Drawings. Provide lap beneath other tack or chalk board systems to conceal unfinished edges.
- F. Attachment: Secure fiberboard to substrate with mechanical attachments per manufacturers requirements and sufficient support to hold in place. Apply adhesive in accordance with manufacturer's instruction.

3.4 TOLERANCES

- A. Maximum Variation from True Flatness: 1/8 inch in 10 feet in any direction.

3.5 CLEANING PROCEDURES

- A. Remove by rubbing lightly with a moistened cloth, sponge, or stiff bristle brush using a mild soap, detergent, or non-abrasive cleanser and clean water.
- B. Strong organic solvents (such as Ketones) and harsh abrasive cleaners are not to be used.
- C. Contact wall covering manufacturer for special cleaning problems and follow their recommendations if required.

END OF SECTION

SECTION 09 90 00

PAINTING AND COATING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide painting and finishing of exposed items and surfaces requiring field painting and finishing including shop primed items.
 - 1. Specified surface preparation, priming and coats of paint are in addition to shop-priming and surface treatment specified under other sections of work.
 - 2. Painting and finishing include field finishing of exterior and interior items not listed as "Surfaces not to be Painted" unless clearly indicated otherwise.
 - 3. Painting and finishing include field finishing of select shop finished items such as mechanical grilles and registers and shop primed items such as access panels and louvers in doors, to match adjacent surfaces.
 - a. Match adjacent surfaces in color and sheen unless otherwise indicated.
 - 4. Field paint exposed bare and covered pipes, ducts, and hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under mechanical and electrical work in occupied spaces.
- B. Surfaces Not to be Painted:
 - 1. Finished items including finished metal surfaces.
 - 2. Labels: Keep equipment identification and fire rating labels free of paint.
- C. Related Sections: Shop priming of ferrous metal items is included under various Specification sections.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's technical information, including paint label analysis and application instructions for each material.
- B. Samples: Submit samples for review of color and texture; provide list of material and application for each coat of each finish sample.
 - 1. Field Samples: Duplicate painted finishes of approved samples on actual components for approval prior to commencing work.
 - a. Size: Minimum 100 sf located where approved.
 - b. Components: One full component as directed.
- C. Manufacturer Certificates: Furnish certificates from each manufacturer stating materials are top quality lines and suitable for intended use on this Project.

1.3 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control for paints and coatings.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to job site in original, new and unopened packages and containers bearing manufacturer's name and label, with:
 - 1. Name of material, color and sheen.
 - 2. Manufacturer's name, stock number and date of manufacture.
 - 3. Contents by volume, for major pigment and vehicle constituents.
 - 4. Thinning and application instructions.

1.5 SITE CONDITIONS

- A. Apply water-base paints when temperature of surfaces and surrounding air are between 50 and 90-degrees F.
- B. Do not apply paint in rain, fog or mist; or when relative humidity exceeds 85 percent; or to damp or wet surfaces.
- C. Painting may be continued during inclement weather if areas to be painted are enclosed and heated within temperature limits specified.
- D. Provide additional temporary ventilation during interior application of paints to eliminate volatile organic compound (VOC) emissions from interior spaces as quickly as possible.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Sherwin-Williams Co.
- B. Pittsburgh Paints, PPG Pittsburgh Paints
- C. Dunn-Edwards Corp.
- D. Vista Paint Co.
- E. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide painting and finishing of exposed items and surfaces requiring field painting and finishing including shop primed items.
 - 1. Definition: "Painting" and "coating" as used herein means systems including primers, emulsions, enamels, stains, sealers and fillers, whether used as prime, intermediate or finish coats.

B. Regulatory Requirements:

1. Volatile Organic Compound (VOC) Emissions: Furnish materials approved for use by applicable air quality management district for limitations of volatile organic compounds for architectural or special coatings as applicable.

C. Material Quality: Provide top line quality commercial grade (professional painter) paints; materials not bearing manufacturer's identification as their top line product shall not be acceptable.

1. Primers: Provide premium grade primers recommended by paint manufacturer for substrates indicated and for finish systems specified.
2. Undercoats and Barrier Coats: Provide undercoat paints produced by same manufacturer as finish coats; use only thinners approved by paint manufacturer and use only within recommended limits.
3. Finish Coats: Provide finish coats capable of being washed with mild detergent without loss of color, sheen, or pigments.
 - a. Color pigments: Pure, non-fading, applicable types to suit substrates and service indicated; no lead content permitted.
4. Finish Coat Coordination: Provide finish coats which are compatible with prime paints, undercoats, and barrier coats used.
 - a. Review other Specification sections in which prime paints are provided; ensure compatibility of total coatings systems.
 - b. Upon request from other trades furnish information on characteristics of finish materials proposed for use.
 - c. Provide barrier coats over incompatible primers or remove and prime as required.
 - d. Notify Architect in writing of any anticipated problems in use of specified coating systems with substrates primed by others.

D. Colors and Finishes: Prior to commencement of painting work, Architect will furnish color chips for surfaces to be painted.

1. Use of proprietary names in color selection is not intended to imply exclusion of equivalent products of other manufacturers.
2. Final acceptance of colors will be from samples applied on site.
3. Colors: Where color is not indicated on Drawings or Finish Schedule, provide standard color as directed by Architect.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Inspection: Examine areas and conditions under which painting work is to be applied.
 - 1. Start of painting work indicates acceptance of surfaces and conditions of surfaces and conditions within any area.
 - 2. Where exposed items or surfaces are not specifically mentioned in Schedules, paint same as adjacent similar materials or areas.
 - 3. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to a durable paint film.
- B. Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as specified for substrate condition.
 - 1. Existing Painted Finishes:
 - a. Clean existing painted surfaces and remove oil, grease, dust, stains, scale, efflorescence, mildew, mold, algae, blisters, and non-adhering paint.
 - b. Measure adhesion of existing paints using ASTM D3359 tape test; remove existing coatings where poor adhesion is indicated.
 - c. Feather edges of severely deteriorated paint where several coats are removed as part of cleaning, to provide smooth transition for new paint.
 - d. Fill holes, cracks, and defects and fill and sand smooth, ready for new paint finish.
- C. Remove hardware, accessories, and items in place and not to be painted, or provide protection prior to surface preparation and painting; after painting reinstall removed items.
- D. Clean surfaces before applying paint; remove oil and grease prior to mechanical cleaning; program cleaning so contaminants from cleaning process do not fall onto wet, newly painted surfaces.
- E. Ferrous Metals: Touch up shop-applied prime coats wherever damaged using same type of primer as applied in shop or barrier coat compatible with finish paint.
 - 1. Galvanized Surfaces: Clean free of oil and surface contaminants, using non-petroleum-based solvent; primer and touch-up primer to be zinc-rich primer.
- F. Mix painting materials in accordance with manufacturer's directions.
- G. Store materials in tightly covered containers; maintain containers used in storage, mixing and application of paint in a clean condition, free of foreign materials and residue.

- H. Stir materials before application to produce mixture of uniform density and stir as required during application; do not stir surface film into material, if necessary, strain material before using.

3.2 APPLICATION

- A. Apply paint in accordance with manufacturer's directions; use applicators and techniques best suited for substrate and type of material being applied.
 - 1. Apply additional coats when stains or blemishes show through final coat, until paint is a uniform finish, color and appearance.
 - 2. Provide extra attention during application to assure dry film thickness at corners and crevices is equivalent to that of flat surfaces.
 - 3. Sand lightly between coats when recommended by system manufacturer.
- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated or prepared for painting as soon as practicable after preparation.
 - 1. Allow time between successive coatings to permit proper drying.
 - 2. Do not recoat until paint feels firm and does not deform or feel sticky under moderate thumb pressure.
- C. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry film thickness as recommended by coating manufacturer.
- D. Prime Coats: Apply to items not previously primed; recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat.
- E. Finish Coats: Provide even texture; leave no laps, irregularity in texture, skid marks, or other surface imperfections.
 - 1. Opaque Finishes: Provide opaque, uniform finish, color and coverage; cloudiness, spotting, holidays, brush marks, runs, sags, ropiness, and other surface imperfections are not acceptable.
- F. Completed Work: Match approved samples for color, texture and coverage; remove, refinish or repaint work not accepted.

3.3 PAINTING SCHEDULE

- A. Exterior Work: Provide following paint systems and sheens unless otherwise indicated.
 - 1. Metal: Semigloss sheen.
 - a. 1st Coat: Touch-up primer, prime if none.
 - b. 2nd and 3rd Coat: Exterior 100% acrylic enamel.
 - 2. Metal: High-performance coating specified in Section 09 96 70.

- a. Refer to Section 09 96 80 – Elastomeric Coating.
- 3. Traffic Line Paint: Manufacturer's standard sheen; colors as required by line or symbol; blue for handicapped parking spaces.
 - a. 1st and 2nd Coat: Water based acrylic/epoxy traffic line paint; other systems subject to prior approval by Architect.

3.2 CLEAN-UP, PROTECTION, AND REPAIR

- A. Clean-Up: During progress of work, remove discarded paint materials, rubbish, cans and rags from site at end of each workday.
 - 1. Clean glass and paint-spattered surfaces immediately by proper methods of washing and scraping, using care not to scratch or damage finished surfaces.
- B. Protection: Protect work of other trades, whether to be painted or not; correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.
 - 1. Provide "Wet Paint" signs to protect newly painted finishes.
 - 2. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.
- C. Repair: At completion of work of other trades, touch-up and restore damaged surfaces or defaced painted surfaces.

END OF SECTION

SECTION 10 11 00

VISUAL DISPLAY BOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide visual display boards including liquid marker type whiteboards and cork tackboards with trim, hardware, and accessories as required for complete installation.
 - 1. Provide horizontal sliding visual display boards where indicated.
 - 2. Provide vertical sliding visual display boards where indicated.

1.2 SUBMITTALS

- A. Shop Drawings: Clearly indicate board sizes and layout, method of attachment, accessories, trim profiles, details and finish.
- B. Samples: Furnish sample whiteboard and tackboard surfaces with samples of aluminum trim and chalk rail, in selected colors and finish.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver materials to site until areas in which they are to be installed are ready to receive them.
- B. Deliver materials to site in protective covering in a manner to protect finishes.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Claridge Products and Equipment, Inc.
- B. Greensteel Division of PolyVision Corporation.
- C. ADP Lemco Inc.
- D. AARCO Products Inc.
- E. K-PRO Specialty Products.
- F. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide visual display boards including liquid marker type whiteboards and cork tackboards with trim, hardware, and accessories.
- B. Steel Sheet for Porcelain Enameling: ASTM A424, minimum 24 gage.

- C. Aluminum Extrusions: ASTM B221, minimum 0.062" wall thickness.
- D. Aluminum Sheet: ASTM B209, minimum 0.015" thick.
- E. Galvanized Steel Sheet: ASTM A1011 or A1008, Class 1; ASTM A924 and A653, G90 coating; minimum 26 gage (0.0179").
- F. Tempered Hardboard: Manufacturer's standard material.
- G. Plywood: PS 1, manufacturer's standard.

2.3 FABRICATION

- A. Whiteboards: Porcelain writing surface manufactured specifically for use with liquid marker systems.
 - 1. Type:
 - a. Claridge/LCS Liquid Chalk System.
 - b. Greensteel/Dry Marker Board.
 - c. ADP Lemco/Markerboards.
 - d. AARCO/Porcelain Steel Markerboards.
 - e. K-PRO/Porcelain Steel Markerboards.
 - f. Substitutions: Refer to Section 01 25 00.
 - 2. Core: Minimum 3/8" thick plywood.
 - 3. Balance porcelain writing surface with aluminum or sheet steel backing, aluminum foil is not acceptable.
 - 4. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
 - 5. Accessories: Provide manufacturer's standard accessories including map hooks and projection screen hooks.
- B. Tackboard: Natural dense, self-healing cork surface with cloth backing mounted on manufacturer's standard backing.
 - 1. Type:
 - a. Claridge/Cortex.
 - b. Greensteel/Cork Tac-Tex.
 - c. ADP Lemco/Colored Cork Tack Boards.
 - d. AARCO/VIC Corkboards.
 - e. K-PRO/1/4" Cork ProCork Tackboards.
 - f. Substitutions: Refer to Section 01 25 00.

- C. Tackboards: 1/4" thick cork face laminated to 1/4" thick tempered hardboard backing, with pliable vinyl surface; edges wrapped; factory applied aluminum trim to match whiteboard trim.
1. Type:
 - a. Claridge/Fabricork Vinyl Tackboards.
 - b. Greensteel/Vinyl Tac-Tex.
 - c. ADP Lemco/Vinyl Covered Cork Tackboards.
 - d. AARCO/Burlap-Weave Vinyl Display Panels.
 - e. K-PRO/Vinyl over Cork Underlamine.
 - f. Substitutions: Refer to Section 01 25 00.
 2. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
 3. Accessories: Provide map hooks and projection screen hooks.
- D. Horizontal Sliding Markerboards: Balanced, 3-ply high-pressure laminated, porcelain enamel writing surface consisting of face sheet, core material and backing; manual.
1. Manufacturers:
 - a. Claridge/Horizontal Sliding Units.
 - b. ADP Lemco Inc./Horizontal Sliding Boards.
 - c. AARCO/Horizontal Sliding Units.
 - d. K-PRO/Horizontal Sliding Units.
 - e. Substitutions: Refer to Section 01 25 00.
 2. Sizes and Configurations: As indicated, as selected by Architect from manufacturer's full range of sizes and configurations where not otherwise indicated.
 3. Markerboard Face Sheets: Porcelain steel markerboard manufactured specifically for use with liquid marker systems and magnetic surface.
 - a. Provide markerboard face sheets for sliding panels and back panel.
 - b. Provide markerboard face sheets and tackboard face sheets for sliding panels and markerboard for back panel.
 4. Tackboard Surfaces: Natural cork tackboards.
 - a. Colors: As indicated, as selected by Architect from manufacturer's full range of colors where not otherwise indicated.
 5. Balance porcelain writing surface with aluminum or sheet steel backing, aluminum foil is not acceptable.
 6. Core: Manufacturer's standard for specified system.
 7. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.

- E. Vertical Sliding Markerboards: Balanced, 3-ply high-pressure laminated, porcelain enamel writing surface consisting of face sheet, core material and backing; manual.
 - 1. Manufacturers:
 - a. Claridge/Vertical Sliding Units.
 - b. AARCO/Vertical Sliding Units.
 - c. K-PRO/Vertical Sliding Units.
 - d. Substitutions: Refer to Section 01 25 00.
 - 2. Sizes and Configurations: As indicated, as selected by Architect from manufacturer's full range of sizes and configurations where not otherwise indicated.
 - 3. Markerboard Face Sheets: Porcelain steel markerboard manufactured specifically for use with liquid marker systems and magnetic surface.
 - a. Provide markerboard face sheets for sliding panels and back panel.
 - 4. Markerboard Face Sheets: Type manufactured specifically for use with liquid marker systems.
 - a. Provide markerboard face sheets for sliding panels and back panel.
 - 5. Balance porcelain writing surface with aluminum or sheet steel backing, aluminum foil is not acceptable.
 - 6. Core: Manufacturer's standard for specified system.
 - 7. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
- F. Frames: Extruded aluminum, factory applied, concealed fastening; integral chalk rail with molded end closures; anodized finish, matching Architect-approved sample.
 - 1. Framed Units: Fabricate one-piece units without joints unless sizes indicated are not available as one-piece units.
 - a. Multiple Units: Provide joints located at whiteboard and tackboard intersection or at areas as approved by Architect; concealed splice joints typical.
 - b. Factory Fabricate: Factory fabricate except where too large for shipping.
- G. Attachment Hardware: Manufacturer's standard fully concealed attachment system for securing units to wall surfaces.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Securely mount whiteboards and tackboards in accordance with manufacturer's recommendations, level and true to line.
 - 1. Multiple Units: Provide flush, butt, hairline joints to ensure a smooth writing surface between whiteboards.
 - 2. Sliding Units: Provide rattle and chatter-free operation; boards to move with maximum 5-pounds pressure and to stop and hold in any position.
- B. Cleaning: At completion of work, clean surfaces and trim, leaving ready for use.

END OF SECTION

SECTION 10 14 00

SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide general signage as indicated complete with attachment devices and accessories as required for complete installation.
- B. Related Sections:
 - 1. Section 09 90 00: Traffic line paint.
 - 2. Section 10 44 00: Fire extinguisher cabinet graphics.
 - 3. Division 26: Photoluminescent exit signs.

1.2 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature and indicate each sign type, style, color, and method of attachment.
- B. Shop Drawings: Furnish listing of sign types, lettering and locations, along with dimensions of each sign.
 - 1. Computerized Output: Furnish computerized samples of signs and graphics at full scale duplicating final appearance.
 - 2. Dimensional Letter Signs: Furnish complete shop drawings regarding fabrication and method of attachment of dimension letter signs.
 - 3. Photoluminescent Egress Path Signage: Submit complete shop drawings indicating locations of luminous egress path markings and signage.
- C. Samples: Furnish full size samples where requested.
- D. Certification: Furnish manufacturer certification that photoluminescent egress path markings and signage conform to California Building Code requirements.

1.3 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control for adhesives.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Package separately or in like groups of names, labeled as to names enclosed; include installation template, attachment system and installation instructions.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. ASI Modulex, ASI Sign Systems, Inc.
- B. Mohawk Sign Systems.
- C. Vomar Products, Inc.
- D. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide signage as indicated with attachment devices and accessories.
- B. Regulatory Requirements: Provide signs for assuring access for persons with disabilities in accordance with state and federal regulations.
 - 1. California Regulations: Comply with California Building Code.
 - 2. Federal Regulations: Comply with Americans with Disabilities Act (ADA) Standards.
- C. Dimensional Letter Signage: Provide individual letter signs as indicated.
 - 1. Aluminum: Manufacturer's standard for individual letter signs.
 - a. Finish: Clear anodized finish, AA-M12C22A41, Class I, AAMA 607.1.
 - 2. Stainless Steel: ASTM A666, Type 304 nonmagnetic corrosion resistant stainless steel with No. 4 satin directional polish finish.
 - 3. Fabrication: Fabricate dimensional letters as indicated, of minimum 0.25" plate or casting with edges and corners smooth and finished to match adjacent metal finishes.
 - 4. Attachment: Secure letters using connections concealed after installation; method subject to Architect approval.
 - a. Take care back welding does not damage exposed sign surfaces.
- D. Toilet Room Door Signs: Provide door signs conforming to California requirements for signs for toilet rooms; concealed mounting system.
 - 1. Material, Plastic: Manufacturer's standard colored plastic/photopolymer signs.
 - a. Texture: Smooth.
 - b. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.

2. Material:
 - a. Aluminum: Manufacturer's standard for individual letter signs.
 - 1) Finish: Clear anodized finish, AA-M12C22A41, Class I, AAMA 607.1.
 - b. Stainless Steel: ASTM A666, Type 304 nonmagnetic corrosion resistant stainless steel with No. 4 satin directional polish finish.
3. Total Thickness: 0.25".
4. Provide signs required by California Code of Regulations Title 24.
 - a. Men's Room: 12" equilateral triangle, vertex pointing up.
 - b. Ladies' Room: 12" diameter circle.
 - c. Unisex Toilet: 12" diameter circle with equilateral triangle, vertex pointing up, superimposed on the circle; circle and triangle each 0.25" thick.
 - 1) Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
5. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
6. Symbols: As selected from manufacturer's standard symbols.
7. Adhesive: Type as recommended by sign manufacturer for type of substrate involved.
- E. Toilet Room Wall Signs: Provide signs conforming to California Building Code and ADA Standards for signs for permanent rooms, with inset symbols and with raised and Braille characters; concealed mounting system.
 1. Material, Plastic: Manufacturer's standard colored plastic/photopolymer signs.
 - a. Texture: Smooth.
 2. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
 3. Material:
 - a. Aluminum: Manufacturer's standard for individual letter signs.
 - 1) Finish: Clear anodized finish, AA-M12C22A41, Class I, AAMA 607.1.
 - b. Stainless Steel: ASTM A666, Type 304 nonmagnetic corrosion resistant stainless steel with No. 4 satin directional polish finish.
 4. Comply with California Building Code and ADA Standards for raised and Braille characters, pictorial symbols, finish, and contrasts requirements.

- F. Entry Decals: Provide minimum 6" square decals with international handicapped symbol white on blue background with white border, applied to glass at accessible entry doors of existing buildings where all entry doors are not accessible.
- G. Stairway Signs: Provide colored plastic/photopolymer signs in stairways, conforming to California Building Standards Code, Section 1022.9.
 - 1. Lettering: Type as required by CBC.
 - 2. Colors, Size, and Style: Conform to referenced code requirements and as approved by Architect.
 - a. Colors: Where color is not indicated on Drawings or Finish Schedule or specifically required by applicable code, provide custom color as directed by Architect.
 - 3. Information: Identify stairway, indicate whether there is roof access, floor level, and upper and lower terminus of stairway, and story of and direction to exit discharge.
 - 4. Provide raised five-pointed star located to left of identifying floor level at exit discharge level.
 - 5. Provide Floor Identification Signs required by CBC including both tactile and Braille sign.
 - 6. Provide photoluminescent egress path marking and signs as required by California Building Code for high rise buildings and as specified for photoluminescent egress markings and signage.
- H. Porcelain Signs at Parking: Provide porcelain enamel on steel sign with beaded text and symbols meeting requirements of California Building Standards Code and with ADA Standards.
 - 1. At entry to parking provide state required sign indicating unauthorized vehicles parking in accessible parking spaces may be towed at owner's expense using exact wording required by CBC.
 - 2. Verify location and telephone number of location vehicle is to be towed with Owner; place this information as permanent part of sign wording.
 - 3. At parking spaces provide California required reflectorized sign, minimum 70 sq. inches, with symbol indicating accessibility.
 - 4. At van accessible parking spaces provide required "VAN PARKING" signs.
- I. Tactile Exit Door Signs: Provide colored plastic/photopolymer signs, conforming to California Building Code Section 1011.3 and ADA Standards for signs for permanent rooms, with tactile raised and Braille characters; concealed mounting system.
 - 1. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
 - 2. Size and Style: As indicated on Drawings.

- J. Room Identification and Direction Signs: Provide signs conforming to California and ADA Standards for permanent signs, total thickness 0.125"; provide raised and Braille characters conforming to California and ADA Standards; concealed mounting.
 - 1. Material, Plastic: Manufacturer's standard colored plastic/photopolymer signs.
 - a. Texture: Smooth.
 - 2. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
 - 3. Material:
 - a. Aluminum: Manufacturer's standard for individual letter signs.
 - 1) Finish: Clear anodized finish, AA-M12C22A41, Class I, AAMA 607.1.
 - b. Stainless Steel: ASTM A666, Type 304 nonmagnetic corrosion resistant stainless steel with No. 4 satin directional polish finish.
 - 4. Sizes and Styles: As indicated on Drawings, as directed by Architect where not otherwise indicated.
- K. Applied Copy Signs and Graphics: Letters and graphics as indicated on Drawings; Contractor option of silk-screen or vinyl applied.
 - 1. Silk-screen Signs and Graphics: Computer design screens for signs and graphics to designs and criteria established by Architect.
 - a. Silk-screen Lacquer: Match Advanced Screen Products/Industrial Gloss Lacquer Silk-screen Ink; colors as selected by Architect.
 - 2. Vinyl Signs and Graphics: Computer design vinyl signs and graphics to designs and criteria established by Architect.
 - a. Vinyl: Opaque non-reflective vinyl film, minimum 0.0035" thick, with pressure sensitive adhesive backing suitable for applications indicated; match 3M/Scotchcal Vinyl Film.
 - 3. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
- L. Tactile Emergency Evacuation Signs: Silk-screened polycarbonate with screening on back and with tactile and Braille information conforming to California requirements and ADA Standards.
 - 1. Information: Provide sign system with information as required by applicable authorities for emergency egress.
 - 2. Silk-Screen Colors:
 - a. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.

- b. Silk-screen Lacquer: Match Advanced Screen Products/Industrial Gloss Lacquer Silk-screen Ink; colors as selected by Architect.
- 3. Size and Style: As indicated on Drawings and acceptable to applicable authorities.
- 4. Attachment: Method subject to Architect approval.
- M. Photoluminescent Egress Path Markings and Signage: Provide exit path marking and signage required by applicable codes including but not limited to exit path markings, stair nosing, handrails, demarcation and obstruction markings, doors, and hardware.
 - 1. Acceptable Manufacturers:
 - a. Balco Inc./IllumiTread Exit Path Markings.
 - b. ZERO International/Exit Marking Systems.
 - c. American Permalight Inc./Egress Path Markings.
 - d. Active Safety/Egress Path Markings.
 - e. Substitutions: Refer to Section 01 25 00.
 - 2. Refer to CBC Title 24, Part 2, Section 1025.
 - 3. System: UL 1994 listed.
 - 4. Photoluminescent exit signs are in Division 26.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install signs in accordance with manufacturer recommendations and installation instructions, free from distortions and defects.
- B. Dimensional Letter Signage: Locate dimensional letters with spacing based on full-size computer-generated installation drawings secured to structure as required to resist anticipated loads.
 - 1. Final Location: As approved in field by Architect based on full size drawings.
- C. Toilet Room Door Signs: Install signs on doors after doors are painted and finished.
 - 1. Location: Mount signs with centerline of sign between 58" and 60" height as required by applicable code.
 - 2. Install centered and level, in line, in accordance with the manufacturer's recommendations.
 - 3. Clean and polish, remove excess adhesive.
- D. Toilet Room Wall Signs: Install signs on walls after surfaces on which they are to be mounted are painted and finished.
 - 1. Location: Mount signs at 48" to 60" height as required by applicable codes on strike side of door.

2. Location: Mount signs with tactile characters 48" minimum (baseline of lowest Braille cells) and 60" maximum (baseline of highest line of raised characters) above finished floor and with on strike side of door for room identification signs as required by applicable codes, at heights indicated on details.
 3. Install level, in line, in accordance with California Building Code and ADA Standards to allow a person to approach within 3" of signs without being within a door swing and without encountering protruding objects.
 4. Clean and polish, remove excess adhesive.
- E. Entry Signs: Install in locations as approved by Architect.
- F. Stair Signs: Install signs inside stairwell after walls are finished, at locations immediately adjacent to door on strike side as required by referenced code, readily visible when door is open.
1. Location: Mount signs at 48" to 60" height as required by applicable codes.
- G. Parking Signs: Provide mounting hardware, including painted posts, as needed; mount signs at heights required by state code.
1. Install parking entry sign at location as directed by Architect.
- H. Tactile Exit Door Signs: Install at doors with lighted "EXIT" signs; apply after walls are finished.
1. Location: Mount signs at 48" to 60" height as required by applicable codes on strike side of door.
 2. Install level, in line, in accordance with the manufacturer's recommendations and ADA Standards to allow a person to approach within 3" of signs without being within a door swing and without encountering protruding objects.
 3. Clean and polish, remove excess adhesive.
- I. Room Identification and Direction Signs: Install signs after walls are finished.
1. Location: Mount signs at 48" to 60" height as required by applicable codes on strike side of door for room identification signs, where indicated for direction signs.
 2. Room Identification Signs Location: Mount signs with tactile characters 48" minimum (baseline of lowest Braille cells) and 60" maximum (baseline of highest line of raised characters) above finished floor and with on strike side of door for room identification signs and where indicated for directional signs.
 3. Install signs level, in line, in accordance with the manufacturer's recommendations, California Building Code and ADA Standards.
 4. Install room identification signs at doors to allow a person to approach within 3" of signs without being within a door swing and without encountering protruding objects.
 5. Clean and polish, remove excess adhesive.

- J. Applied Copy Signs and Graphics: Examine surfaces and construction for conditions adversely affecting installation, performance and quality of work.
 - 1. Apply signage and graphics centered and level, in line, in accordance with manufacturer's recommendations.
- K. Emergency Evacuation Signs: Install signs after walls are finished.
 - 1. Location: Mount signs at locations indicated, as directed by Architect and applicable authorities if not otherwise indicated.
 - 2. Install signs level and in accordance with the manufacturer's recommendations and requirements of applicable authorities.
 - 3. Clean and polish.
- L. Photoluminescent Egress Path Markings and Signage: Install exit path marking and signage as required by applicable codes.

END OF SECTION

SECTION 10 28 00

TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide toilet accessories with attachment hardware and rough-in frames as required for complete operational installation.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's product data illustrating each accessory at large scale.
- B. Samples: Provide one sample of each type of fixture specified.

1.3 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control for adhesives.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver inserts and rough-in frames to jobsite at appropriate time for building in.
- B. Do not deliver accessories to site until rooms in which they are to be installed are ready to receive them.
- C. Pack accessories individually, protect each item and its finish.

1.5 SITE CONDITIONS

- A. Protect adjacent or adjoining finished surfaces from damage during installation of work of this section.
- B. Before starting work notify Architect in writing of conditions detrimental to installation or operation of units.
- C. Verify with Architect exact location of accessories.

1.6 WARRANTY

- A. Extended Correction Period:
 - 1. Replace mirrors which exhibit signs of desilvering or distortion.
 - 2. Period: Two years.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. Bobrick Washroom Equipment, Inc.
- B. Bradley Corporation.
- C. American Specialties, Inc.
- D. Manufacturers listed on Toilet Accessories Schedules.
- E. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide toilet accessories with attachment hardware and rough-in frames.
 - 1. Provide standard materials and finishes for accessories listed; where more than one material or finish is available and not otherwise indicated provide as selected by Architect from manufacturer's standard materials and finishes.
- B. Regulatory Requirements - Access for Persons with Disabilities: Comply with California Building Standards Code and Americans with Disabilities Act (ADA) Standards.
- C. Stainless Steel Sheet: ASTM A666, commercial grade, Type 304, gages as standard with manufacturer of specified items.
- D. Stainless Steel Tubing: ASTM A269, commercial grade, seamless welded.
- E. Mirror Glass: ASTM C1036, q1 mirror select clear float glass with full silver coating, copper coating and organic coating; minimum 1/4" thick.
- F. Sheet Steel: ASTM A1008, cold rolled stretcher leveled; minimum G90 galvanized coating, ASTM A924 and A653.
- G. Adhesive: Epoxy type contact cement as recommended by accessory manufacturer; comply with applicable requirements for limitations on volatile organic compound (VOC) emissions.
- H. Fasteners, Screws, and Bolts: Hot dip galvanized; as recommended by accessory manufacturer for component and substrate.
- I. Keys: Provide universal keys for access to toilet accessory units requiring internal access for servicing and supply.
 - 1. Provide minimum six keys to Owner representative.
 - 2. Coin Operated Units: Provide locked coin box keyed separately from standard units, coin operated units keyed alike.

2.3 FABRICATION

- A. Weld and grind smooth joints of fabricated components.
- B. Form exposed surfaces from one sheet of stock, free of joints.
- C. Fabricate units with tight seams and joints, exposed edges rolled; hang doors and access panels with continuous piano hinges; provide concealed anchorage where possible.
- D. Provide steel anchor plates and anchor components for installation on building finishes.
- E. Form surfaces flat without distortion; maintain flat surfaces without scratches and without dents; finish exposed edges eased, free of sharp edges where potential exists for physical contact.
- F. Back paint components where contact is made with building finishes, to prevent electrolysis.
- G. Hot-dip galvanize ferrous metal anchors and fastening devices.
- H. Assemble components in shop; package complete with anchors and fittings.

2.4 FINISHES

- A. Exposed Finishes: Stainless steel, number 4, satin finish; satin chrome finish acceptable where stainless steel not available for accessory item listed or scheduled.
- B. Concealed Surfaces: Treat and clean, spray-apply one coat primer and baked enamel finish.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Provide templates and rough-in measurements.

3.2 INSTALLATION

- A. Install accessories in accordance with manufacturer's printed instructions using fasteners appropriate to substrate.
- B. Install true, plumb and level, securely and rigidly anchored to substrate.
- C. Use tamper-proof, security type fasteners.
- D. Adjust accessories for proper operation and verify mechanisms function smoothly.
- E. Replace damaged and defective items.
- F. Clean and polish exposed surfaces after removing temporary labels.

3.3 TOILET ACCESSORIES SCHEDULE

- A. Refer to Drawings.

END OF SECTION

SECTION 10 44 00

FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide semi-recessed cabinets for portable fire extinguishers with accessories as required for complete installation.
 - 1. Fire Extinguishers: Owner furnished and installed.
- B. Related Sections:
 - 1. Division 21: Fire protection systems.

1.2 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

- A. J.L. Industries.
- B. Larsen's Manufacturing Co.
- C. Potter Roemer.
- D. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

- A. System Description: Provide semi-recessed cabinets for portable fire extinguishers with accessories.
- B. Fire Extinguisher Cabinets: Provide semi-recessed mounting unless otherwise indicated, maximum 4" extension beyond wall finish surface, provide trim suitable for installation indicated.
 - 1. Type:
 - a. J.L. Industries/Ambassador Series.
 - b. Larsen's Mfg. Co./Architectural Series.
 - c. Potter Roemer/Alta Series.
 - d. Substitutions: Refer to Section 01 25 00.
 - 2. Typical Cabinet Depth: Provide cabinets designed for space available in walls with fire extinguisher cabinets, and of depth to house 2A-10BC multi-purpose dry chemical type fire extinguisher.

3. Food Preparation Areas: Provide cabinets designed to house K Type fire extinguisher at locations indicated on Drawings or designated as food preparation areas where burning grease could be encountered.
 4. Hazardous Areas (Garage): Provide cabinets designed to house 4A-60BC multi-purpose dry chemical type fire extinguisher at locations indicated on Drawings or designated as hazardous.
- C. Trim: Manufacturer's standard edge trim for specified models.
- D. Metal Gages: Provide manufacturer's standard gages for cabinets specified.
1. Surface Mounted Cabinets (Garage): Minimum 18-gage typical, 20-gage at back.
- E. Construction: Mitered and welded one-piece tubular door frames; weld joints and grind smooth; manufacturer's standard steel box with white baked enamel interior finish and primed exterior finish.
1. Steel Doors and Trim: Manufacturer's standard, prime coat finished.
 2. Doors: Break-glass type secured access, with inside latch and lock.
 3. Door Hardware: Continuous hinge permitting door to open 180-degrees.
- F. Fire Rated Wall Construction: Provide fire extinguisher cabinet manufacturer's material as required to maintain integrity of fire rated partitions where cabinets are in fire rated partitions.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine substrates and conditions under which fire extinguisher cabinets are to be installed.
- B. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install cabinets in locations and at mounting height to comply with requirements of governing authorities; prepare recesses in walls as required.
- B. Securely fasten to structure, square and plumb, in accordance with manufacturer's instructions.
 1. Wherever exact location of units is not shown, locate as directed by Architect.

3.3 IDENTIFICATION

- A. After installation and finishing is completed, silk screen or apply decal letters spelling "FIRE EXTINGUISHER" as applicable.
- B. Letter size, style and location as selected by Architect.

END OF SECTION

SECTION 11 10 00

MISCELLANEOUS EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide miscellaneous equipment with hardware and accessories as required for complete secure and operational installation as applicable.
 - 1. Provide ceiling fans.
 - 2. Provide library book drop.
 - 3. Provide metal benches.
 - 4. Provide safes.
 - 5. Provide lecterns.
- B. Related Sections:
 - 1. Section 06 10 50: Wood blocking.
 - 2. Division 26: Electrical service.

1.2 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature.
- B. Shop Drawings: Show complete details of equipment including dimensions and field measurements.

1.3 DELIVERY, STORAGE AND HANDLING

- A. Deliver inserts and rough-in frames to jobsite at appropriate time for building in.
- B. Do not deliver miscellaneous equipment to site until spaces in which they are to be installed are ready to receive them.
- C. Pack miscellaneous equipment individually, protect each item and its finish.

1.4 SITE CONDITIONS

- A. Protect adjacent or adjoining finished surfaces from damage during installation of work of this section.
- B. Before starting work notify Architect in writing of conditions detrimental to installation or operation of units.
- C. Verify with Architect exact location of miscellaneous equipment.

1.5 WARRANTY

- D. Extended Correction Period: Repair or replace miscellaneous equipment which does not function as intended.

1. Period: Two years.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. System Description: Provide miscellaneous equipment with hardware and accessories as applicable.
- B. Regulatory Requirements - Access for Persons with Disabilities: Comply with California Building Standards Code and Americans with Disabilities Act (ADA) Standards.
- C. General: Provide standard materials and finishes for miscellaneous equipment listed; where more than one material or finish is available and not otherwise indicated provide as selected by Architect from manufacturer's standard materials and finishes.
- D. Ceiling Fans: Overhead mounted with 4" long support rod and concealed attachment, for 12" overall length from face of ceiling to bottom of fan unit; UL listed.
1. Type: The Modern Fan Co./Plum Ceiling Fan.
2. Type: The Modern Fan Co (541.482.8545)/Plum Ceiling Fan, #PLU-GW-42-WH-NL-001.
3. Finish: Gloss White.
4. Blade Diameter: 42" span.
5. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
6. Control: Fan speed only.
- a. Power: 120 V.A.C.
- b. Switches: Provide wall mounted switches matching light fixture switches.
- E. Attachments and Accessories: Provide for complete secure operational installation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install miscellaneous equipment in accordance with manufacturer's recommendations and installation instructions, level, true to line, and in correct relation to adjacent materials and finishes.
- B. Coordinate electrical connections with Division 26.
- C. Upon completion of installation, instruct Owner's personnel in operation and maintenance of electrical miscellaneous equipment.

END OF SECTION

SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Transition fittings.
 - 3. Dielectric fittings.
 - 4. Mechanical sleeve seals.
 - 5. Sleeves.
 - 6. Escutcheons.
 - 7. Grout.
 - 8. Equipment installation requirements common to equipment sections.
 - 9. Painting and finishing.
 - 10. Concrete bases.
 - 11. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

- 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.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Transition fittings.
 - 2. Dielectric fittings.
 - 3. Mechanical sleeve seals.
 - 4. Escutcheons.
- B. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.

- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section 08 31 13 "Access Doors and Frames."

1.8 DISCREPANCIES

- A. The Contractor shall check all Drawings furnished immediately upon their receipt and shall promptly notify the Owner's Representative of any discrepancies.
- B. Where requirements between Drawings and Specifications conflict, the more restrictive provisions shall apply.
- C. If any part of the Specifications or Drawings appears unclear or contradictory, apply to Owner's Representative for interpretation and decision as early as possible, including during bidding period. Do not proceed with such work without Owner Representatives decision. Beginning work of any Section constitutes acceptance of conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 15 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Division 15 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. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
1. Available Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Dresser Industries, Inc.; DMD Div.
 - c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
 - d. JCM Industries.
 - e. Smith-Blair, Inc.
 - f. Viking Johnson.
 2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
 3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.

2.5 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.

- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
 - 1. Available Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Eclipse, Inc.
 - d. Epco Sales, Inc.
 - e. Hart Industries, International, Inc.
 - f. Watts Industries, Inc.; Water Products Div.
 - g. Zurn Industries, Inc.; Wilkins Div.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
 - 1. Available Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Epco Sales, Inc.
 - d. Watts Industries, Inc.; Water Products Div.
- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - 1. Available Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.
- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

1. Available Manufacturers:
 - a. Calpico, Inc.
 - b. Lochinvar Corp.
- G. 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.
 1. Available Manufacturers:
 - a. Perfection Corp.
 - b. Precision Plumbing Products, Inc.
 - c. Sioux Chief Manufacturing Co., Inc.
 - d. Victaulic Co. of America.

2.6 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 1. Manufacturers:
 - a. Thunderline Link Seal
 - b. Calpico, Inc.
 - c. Metraflex Co.
 2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 3. Pressure Plates: Stainless steel. Include two for each sealing element.
 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
- E. Underdeck Clamp: Clamping ring with set screws.
- F. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.8 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
- D. Finish: Polished chrome-plated.
- E. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
- F. Finish: Polished chrome-plated.
- G. One-Piece, Stamped-Steel Type: With set screw and chrome-plated finish.
- H. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw, and chrome-plated finish.
- I. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- J. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 15 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. 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 with spring clips.
 - 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.
 - h. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
 - i. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
- M. Sleeves are not required for core-drilled holes.

- N. Permanent sleeves are not required for holes formed by removable PE sleeves.
- O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- 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. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - 3. Install sleeves that are 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 NPS 6.
 - b. Steel Sheet Sleeves: For pipes NPS 6 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 Section "Sheet Metal Flashing and Trim" for flashing.
 - 1) Seal space outside of sleeve fittings with grout.
 - 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.
- Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 - 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
 - 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

- R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration Firestop Systems" 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.

3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 15 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic 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. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
 - 3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - 5. PVC Nonpressure Piping: Join according to ASTM D 2855.
 - 6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- L. 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.
- M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.3 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install 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.
- D. Install equipment to allow right of way for piping installed at required slope.

3.5 PAINTING

- A. Painting of mechanical systems, equipment, and components is specified in Division 9.
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.6 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 5 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

END OF SECTION

SECTION 22 05 19

METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. METERS AND GAGES FOR PLUMBING PIPING consists of furnishing transportation, labor, materials, and equipment to furnish and install the following meters and gages for mechanical systems:
 - 1. Thermometers
 - 2. Gages
 - 3. Test plugs

1.2 RELATED WORK

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 of these specifications.
- B. DOMESTIC WATER PIPING - Section 221116
- C. FACILITY NATURAL GAS PIPING - Section 221110
- D. COMMON WORK RESULTS FOR PLUMBING - Section 220500

1.3 REFERENCES

- A. American Society of Mechanical Engineers (ASME)

1.4 QUALITY ASSURANCE

- A. Codes and Standards:
 - 1. All governing Code, Ordinance and Agencies, in accordance with the provisions of Division 1 of these specifications.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated; include performance curves.
- B. Product Certificates: For each type of thermometer, gauge, flowmeter and thermal-energy meter, signed by product manufacturer.
- C. Operation and Maintenance Data: For flowmeters and thermal-energy meters to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 METAL-CASE, LIQUID-IN-GLASS THERMOMETERS

- A. Manufacturers:
 - 1. Palmer - Wahl Instruments Inc.
 - 2. Weiss Instruments, Inc.
 - 3. Terice, H.O. Co.
- B. Case: Die-cast aluminum or brass, 7 inches long.
- C. Tube: Red or blue reading, mercury or organic-liquid filled, with magnifying lens.
- D. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.
- E. Window: Glass.
- F. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.
- G. Stem: Copper-plated steel, aluminum, or brass for thermowell installation and of length to suit installation.
- H. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.2 PRESSURE GAGES

- A. Manufacturers:
 - 1. Palmer – Wahl Instruments Inc.
 - 2. Terice, H. O. Co.
 - 3. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
- B. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.
 - 1. Case: Liquid-filled type, drawn steel or cast aluminum, 6-inch diameter.
 - 2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
 - 3. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.
 - 4. Movement: Mechanical, with link to pressure element and connection to pointer.

5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
 6. Pointer: Red or other dark-color metal.
 7. Window: Glass.
 8. Ring: Metal.
 9. Accuracy: Grade B, plus or minus 2 percent of middle half scale.
 10. Vacuum-Pressure Range: 30-inch Hg of vacuum to 15 psig of pressure.
 11. Range for Fluids under Pressure: Two times operating pressure.
- C. Pressure-Gage Fittings:
1. Valves: NPS 1/4 brass or stainless-steel needle type.
 2. Syphons: NPS 1/4 coil of brass tubing with threaded ends.
 3. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

2.3 TEST PLUGS

- A. Manufacturers:
1. Flow Design, Inc.
 2. MG Piping Products Co.
 3. Watts Industries, Inc.; Water Products Div.
- B. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.
- C. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.
- D. Core Inserts: One or two self-sealing rubber valves.
1. Insert material for air, water, oil, or gas service at 20 to 200 degrees F shall be CR.
 2. Insert material for air or water service at minus 30 to plus 275 degrees F shall be EPDM.

PART 3 - EXECUTION

3.1 THERMOMETER APPLICATIONS

- A. Install liquid-in-glass thermometers in the following locations:
 - 1. Outlet of each domestic water heater.
 - 2. Each domestic hot water return pipe.
- B. Provide the following temperature ranges for thermometers:
 - 1. Domestic Hot Water: 30 to 180 degrees F, with 2-degree scale divisions.

3.2 GAGE APPLICATIONS

- A. Install dry-case-type pressure gages for discharge of each pressure-reducing valve.

3.3 INSTALLATIONS

- A. Install direct-mounting thermometers and adjust vertical and tilted positions.
- B. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.
- C. Install test plugs in tees in piping.

3.4 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance for meters, gages, machines, and equipment.

3.5 ADJUSTING

- A. Adjust faces of thermometers and gages to proper angle for best visibility.

END OF SECTION

SECTION 22 05 23

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. GENERAL-DUTY VALVES FOR PLUMBING PIPING consists of furnishing transportation, labor, materials, and equipment to furnish and install the following general-duty valves:
 - 1. Ball valves.
 - 2. Check valves.
 - 3. Gate valves.

1.2 RELATED WORK

- A. Drawings and general provision of the Contract, including General and Supplementary Conditions and Division 01 of these specifications.
- B. COMMON WORK RESULTS FOR PLUMBING - Section 220500
- C. IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT - Section 220553
- D. DOMESTIC AND RECYCLED WATER PIPING - Section 221116

1.3 REFERENCES

- A. American Society of Mechanical Engineers (ASME)
- B. American Water Works Association (AWWA)

1.4 SUBMITTALS

- A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

1.5 QUALITY ASSURANCE

- A. Codes and Standards:
 - 1. All governing Codes, Ordinance and Agencies, in accordance with the provisions of Division 01 of these specifications.
- B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valved dimensions and design criteria.
 2. ASME B31.9 for building service piping valves.
- C. NSF Compliance: NSF 61-G for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
1. Protect internal parts against rust and corrosion.
 2. Protect threads, flange faces, grooves, and weld ends.
 3. Set gate valves closed to prevent rattling.
 4. Set ball and plug valves open to minimize exposure of functional surfaces.
 5. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
1. Maintain valve end protection.
 2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 - PRODUCTS

2.1 VALVES, GENERAL

- A. Refer to Valve Applications Article in this Section for applications of valves.
- B. Bronze valves shall be made with dezincification-resistant materials.
1. Valves for potable water must comply with California Lead Free Law.
 2. Lead free refers to the wetted surface of pipe, fittings and fixtures in potable water systems that have a weighted average lead content $\leq 0.25\%$. Source: California Health Safety Code (116875).
 3. All valves must be 3rd party certified.
- C. Bronze Valves: NPS 2 and smaller with threaded ends, unless otherwise indicated.
- D. Ferrous Valves: NPS 2-1/2" and larger with flanged ends, unless otherwise indicated.
- E. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

- F. Valve Sizes: Same as upstream pipe, unless otherwise indicated.
- G. Valve Actuator Types:
 - 1. Handwheel: For valves other than quarter-turn types.
 - 2. Handlever: For quarter-turn valves NPS 6 and smaller, except plug valves.
 - 3. Locking Handlever: All valves used in recycled water piping shall be provided with locking handlevers.
- H. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
 - 1. Gate Valves: With non-rising stem.
 - 2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeves that allows operation of valve without breaking the vapor seal or disturbing insulation and memory stops that are fully adjustable after insulation is applied.
- I. Valve-End Connections:
 - 1. Flanged: With flanges according to ASME B16.1 for iron valves, ASME B16.5 for steel valves.
 - 2. Solder Joint: With sockets according to ASME B16.18.
 - 3. Threaded: With threads according to ASME B1.20.1.
- J. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE BALL VALVES

- A. 2 ½ in. and smaller: Two-Piece, Bronze Ball Valves, Dezincification resistant lead free bronze body with full-port, stainless steel ball and trim; TFE seats; and 600-psig minimum cold working pressure rating and blowout-proof stem, MSS SP-110, NSF-61-G. Provide with locking lever handle feature where used in recycled water piping.
 - 1. Manufacturers:
 - a. Conbraco Industries, Inc.; Apollo Division: Model 77CLF-100 Series
 - b. NIBCO INC., Model T-685-80-66-LF
- B. 3 in. and larger: Two-Piece, Bronze Ball Valves: Dezincification resistant lead free bronze body with standard-port, chromium-plated ball and trim; RPTFE seats; and 600-psig minimum cold working pressure rating and blowout-proof stem. Provide with locking lever handle feature where used in recycled water piping.
 - 1. Manufacturers:
 - a. Conbraco Industries, Inc.; Apollo Division: Model 70LF-100 Series

2.3 BRONZE CHECK VALVES

- A. 3 in. and smaller: Y-pattern, Class 125, Bronze, Horizontal Swing Check Valves: Dezincification resistant lead free bronze body with renewable nonmetallic disc and bronze seat, MSS SP-80.
 - 1. Manufacturers:
 - a. Conbraco Industries, Inc.; Apollo Division: Model 61Y-LF Series
 - b. NIBCO INC., Model T-413-Y-LF

2.4 BRONZE GATE VALVES

- A. 3 in and smaller: Bronze Alloy construction, screw-in bonnet, Non-rising stem, Lead-Free bronze body with bronze solid wedge, dezincification Resistant, MSS SP-80.
 - 1. Manufacturers:
 - a. NIBCO INC., Model S or T-113-LF
 - b. Conbraco Industries, Inc.; Apollo Division: Model 30-LF Series.

2.5 Ductile-IRON GATE VALVES

- A. 4" and larger: Class 125, Bolted Bonnet, non-rising stem, resilient-wedge, flanged ends, 250 psi, epoxy coated inside and outside, ductile iron body, Lead-Free.
 - 1. Manufacturers:
 - a. NIBCO INC., Model F-619-RW

2.6 SPRING-LOADED CHECK VALVES

- A. In-Line Check Valve: 2 in. and smaller; Lead-Free Bronze body, threaded, stainless steel spring, 400 psi CWP.
 - 1. Manufacturers:
 - a. NIBCO, INC., Model T-413-Y-LF.
 - b. Conbraco Industries, Inc., Apollo Division: Model CVB-61-100-LF Series.
- B. Dual Check Valve: 2 in. and smaller; Lead-Free composite body, corrosion resistant internal parts, two (2) independently operated in-line spring-loaded modular checks.
 - 1. Manufacturers:
 - a. Wilkins Model 705-XL.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- D. Examine threads on valve and mating pipe for form and cleanliness.
- E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE APPLICATIONS

- A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball, or gate valves.
 - 2. Throttling Service: Ball valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
- C. Domestic Water Piping: Use the following types of valves:
 - 1. Ball Valves: NPS 2 ½ in. and Smaller; Bronze Lead-Free Ball Valves, Two-piece, Full-Port, 600-psig CWP rating with stainless steel ball. NPS 3 in and larger; Bronze Lead-Free Ball Valves, Two-piece, standard-port, 600 psi CWP rating with chromium-plated ball.
 - 2. Swing Check Valves, NPS 3 and Smaller: Lead-Free, "Y"-Pattern, Class 125, bronze.
 - 3. Swing Check Valves, NPS 4 and Larger: Type II, Class 125, ductile iron.
 - 4. Spring-Loaded Check Valves, NPS 2 and Smaller: Class 125, Bronze, stainless steel spring.

5. Gate Valves, NPS 3 in. and smaller: Lead-Free, Bronze, non-rising stem, Lead-Free, Class 125. NPS 4 in. and larger; Ductile iron body, Lead-Free, epoxy coated, flanged ends.
- D. Recycled Water Piping: Valves shall be the same as for domestic water piping except as follows:
 1. Recycled Water Control Valves: Lever handle valves equipped with a locking feature and painted purple to match the mylar wrapping tape.

3.3 VALVE INSTALLATION

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- C. Locate valves for easy access and provide separate support where necessary.
- D. Install valves in horizontal piping with stem at or above center of pipe.
- E. Install valves in position to allow full stem movement.
- F. Install check valves for proper direction of flow and as follows:
 1. Swing Check Valves: In horizontal position with hinge pin level.
 2. Lift Check Valves: With stem upright and plumb.

3.4 JOINT CONSTRUCTION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for basic piping joint construction.
- B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION

SECTION 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Hangers and supports for plumbing piping and equipment consists of furnishing transportation, labor, materials and equipment to furnish and install the following:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Thermal-hanger shield inserts.
 - 5. Fastener systems.
 - 6. Pipe stands.
 - 7. Pipe positioning systems.
 - 8. Equipment supports.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
 - 2. Division 22 Section "Noise, Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 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."

1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes, including pipe stands, capable of supporting

combined weight of supported systems, system contents, and test water.

- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 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. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Welding: Welding shall be performed only by qualified welders, and shall comply with ASME Boiler Construction Code, ANSI Code and State of California requirements.
- B. Codes and Standards:
 - 1. All governing codes, ordinances and agencies, in accordance with the provisions of Division 1 of these specifications.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 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. ERICO/Michigan Hanger Co.
 3. Hilti Inc.
 4. 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.

2.3 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.

2.4 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. ERICO/Michigan Hanger Co.; ERISTRUT Div.
 3. Hilti Inc.
 4. Tolco Inc.
 5. Unistrut Corp.; Tyco International, Ltd.
- C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 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.
- 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.

2.6 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. Powers Fasteners.
- B. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Manufacturers:
 - a. B-Line Systems, Inc.; a division of Cooper Industries.
 - b. Hilti, Inc.
 - c. ITW Ramset/Red Head.
 - d. Powers Fasteners.

2.7 PIPE STAND FABRICATION

- A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
 - 1. Manufacturers:
 - a. ERICO/Michigan Hanger Co.

b. MIRO Industries.

- C. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.8 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.
- B. Manufacturers:
1. C & S Mfg. Corp.
 2. HOLDRITE Corp.; Hubbard Enterprises.
 3. Samco Stamping, Inc.

2.9 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.10 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

PART 3 - EXECUTION

3.1 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, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
5. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
6. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
7. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
8. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
9. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
10. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
11. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
12. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
13. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
14. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
15. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
16. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be

required in addition to expansion and contraction.

- 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.
- 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. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint 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. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 - 8. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 - 9. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.

10. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 11. 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.
 12. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 13. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 14. 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 Base Supports (MSS Type 52): Preset to indicated load and

limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.

7. 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.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- 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.

3.2 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. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled fiberglass struts.
- E. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- F. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- G. Pipe Stand Installation:
 - 1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 - 2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Section "Roof Accessories" for curbs.
- H. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 Section "Plumbing Fixtures" for plumbing fixtures.
- I. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- J. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- K. 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.
- L. Install lateral bracing with pipe hangers and supports to prevent swaying.
- M. 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.
- N. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

- O. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.
- P. Insulated Piping: Comply with the following:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
 - 5. Pipes NPS 8 and Larger: Include wood inserts.
 - 6. Insert Material: Length at least as long as protective shield.
 - 7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 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.

3.4 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.

3.5 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.

3.6 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 09
- 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 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Identification for plumbing piping and equipment consists of furnishing transportation, labor, materials, and equipment to furnish and install the following:
 - 1. Pipe labels.
 - 2. Valve tags.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. COMMON WORK RESULTS FOR PLUMBING - Section 220500

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

1.5 QUALITY ASSURANCE

- A. Codes and Standards:
 - 1. All governing codes, ordinances and agencies, in accordance with the provisions of Division 1 of these specifications.

PART 2 - PRODUCTS

2.1 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/4 inches high for pipe sizes 2-1/2 to 6 inches, 3/4 inch high for pipe sizes 1-1/2 to 2 inches and 1/2 high for pipe sizes 1/2 to 1-1/4 inches.
 - 3. Color Field Length: At least 12 inches for pipe sizes 2-1/2 to 6 inches and 8 inches for pipe sizes 1/2 to 2 inches.
 - 4. Non-potable water systems shall have the words "CAUTION: NON-POTABLE WATER, DO NOT DRINK" in upper case lettering.

2.2 VALVE TAGS

- A. Valve Tags: Provide a valve tag consisting of a 2 in. dia., 20 ga. brass disk for each valve with 1/2 in. letters identifying service designation. Fasten tags in place with continuous chain around valve stem.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 PIPE LABEL INSTALLATION

- A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Pipe Label Color Schedule:

1. Domestic Water Piping:
 - a. Background Color: Green.
 - b. Letter Color: White.
2. Industrial Cold Water Piping:
 - a. Background Color: Yellow
 - b. Letter Color: Black
3. Sanitary Waste and Storm Drainage Piping:
 - a. Background Color: Green.
 - b. Letter Color: White.

3.3 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.

END OF SECTION

SECTION 22 07 16

PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions.

1.2 SUMMARY

- A. Section Includes:

- 1. Insulation Materials:
 - a. Cellular glass.
 - b. Flexible elastomeric.
 - c. Mineral fiber.
 - d. Phenolic.
- 2. Adhesives.
- 3. Mastics.
- 4. Lagging adhesives.
- 5. Sealants.
- 6. Factory-applied jackets.
- 7. Field-applied jackets.
- 8. Tapes.
- 9. Securements.
- 10. 10. Corner angles.

- B. Related Sections:

- 1. Division 15 Section "Plumbing Insulation."
- 2. Division 15 Section "Metal Ducts" for duct liners.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).
- B. Qualification Data: For qualified Installer.
- 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 and test methods employed.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 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.

1.6 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 15 Section "Hangers and Supports."
- B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Micro-Lok.
 - b. Knauf Insulation; 1000 Pipe Insulation.
 - c. Owens Corning; Fiberglas Pipe Insulation.
 - 2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- G. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ jacket complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in. /h x sq. ft. x deg F or less. 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.; CrimpWrap.
 - b. Johns Manville; MicroFlex.
 - c. Knauf Insulation; Pipe and Tank Insulation.

- d. Owens Corning; Fiberglas Pipe and Tank Insulation.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.
- C. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.
- D. PVC Jacket Adhesive: Compatible with PVC jacket.
 - 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. Dow Chemical Company (The); 739, Dow Silicone.
 - b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. P.I.C. Plastics, Inc.; Welding Adhesive.
 - d. Red Devil, Inc.; Celulon Ultra Clear.

- e. Speedline Corporation; Speedline Vinyl Adhesive.

2.3 SEALANTS

- A. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
 - 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 Products, Division of ITW; CP-76.
 - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 3. Fire- and water-resistant, flexible, elastomeric sealant.
 - 4. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 5. Color: White.

2.4 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.

2.5 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 - 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. Johns Manville; Zeston.
 - b. P.I.C. Plastics, Inc.; FG Series.
 - c. Proto PVC Corporation; LoSmoke.
 - d. Speedline Corporation; SmokeSafe.
 - 2. Adhesive: As recommended by jacket material manufacturer.

3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
5. Factory-fabricated tank heads and tank side panels.

C. Metal Jacket:

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 Products, Division of ITW; Metal Jacketing Systems.
 - b. PABCO Metals Corporation; Surefit.
 - c. RPR Products, Inc.; Insul-Mate.
2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.
 - a. Sheet and roll stock ready for shop or field sizing.
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
 - d. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
 - e. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) Tee covers.
 - 4) Flange and union covers.
 - 5) End caps.
 - 6) Beveled collars.
 - 7) Valve covers.

- 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.6 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
 - b. Compac Corp.; 104 and 105.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
 2. Width: 3 inches.
 3. Thickness: 11.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. 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, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
 - b. Compac Corp.; 130.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
 - d. 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
 2. Verify that surfaces to be insulated are clean and dry.
 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL APPLICATION REQUIREMENTS

- A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.
- B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping 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 insulation with longitudinal seams at top and bottom of horizontal pipe runs.
- E. Apply 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. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

- H. Keep insulation materials dry during application and finishing.
- I. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
- J. Apply insulation with the least number of joints practical.
- K. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.
- L. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.
 - 1. Apply insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
 - 3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.
- M. Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
- N. Apply adhesives and mastics at the manufacturer's recommended coverage rate.
- O. Apply insulation with integral jackets as follows:
 - 1. Pull jacket tight and smooth.
 - 2. Circumferential Joints: Cover with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches o.c.
 - 3. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches. Apply 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. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.

4. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.
 5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.
- P. 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. Extend metal jacket of exterior insulation outside roof flashing at least 2 inches below top of roof flashing.
 4. Seal metal jacket to roof flashing with vapor-retarder mastic.
- Q. Exterior Wall Penetrations: For penetrations of below-grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor-retarder mastic.
- R. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.
- S. Fire-Rated Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated walls and partitions.
1. Firestopping and fire-resistive joint sealers are specified in Division 7 Section "Firestopping."
- T. Floor Penetrations: Apply insulation continuously through floor assembly.
1. For insulation with vapor retarders, seal insulation with vapor-retarder mastic where floor supports penetrate vapor retarder.

3.4 MINERAL-FIBER INSULATION APPLICATION

- A. Apply insulation to straight pipes and tubes as follows:
1. Secure each layer of preformed pipe insulation to pipe with wire, tape, or bands without deforming insulation materials.
 2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder to ends of insulation at intervals of 15 to 20 feet to form a vapor retarder between pipe insulation segments.
 3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches o.c.

4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.
- B. Apply insulation to flanges as follows:
1. Apply preformed pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
 4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch, and seal joints with vapor-retarder mastic.
- C. Apply insulation to fittings and elbows as follows:
1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
 2. When premolded insulation elbows and fittings are not available, apply mitered sections of pipe insulation, or glass-fiber blanket insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.
 3. Cover fittings with standard PVC fitting covers.
 4. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
- D. Apply insulation to valves and specialties as follows:
1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
 2. When premolded insulation sections are not available, apply glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to strainer basket without disturbing insulation.
 3. Apply insulation to flanges as specified for flange insulation application.

4. Use preformed heavy PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

3.5 FIELD-APPLIED JACKET APPLICATION

- A. Apply PVC fitting and valve covers at indoor applications. Seal with manufacturers recommended adhesive.
- B. Apply metal jacket at outdoor applications, with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.6 PIPING SYSTEM APPLICATIONS

- A. Insulation materials and thicknesses are specified in schedules at the end of this Section.
- B. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:
 1. Flexible connectors.
 2. Vibration-control devices.
 3. Fire-suppression piping.
 4. Drainage piping located in crawl spaces, unless otherwise indicated.
 5. Below-grade piping, unless otherwise indicated.
 6. Chrome-plated pipes and fittings, unless potential for personnel injury.
 7. Air chambers, unions, strainers, check valves, plug valves, and flow regulators.

3.7 INSULATION APPLICATION SCHEDULE, GENERAL

- A. Domestic hot and recirculated water:
 1. 1" and smaller: Mineral fiber pre-formed pipe insulation: 1/2" thick.
 2. 1-1/4" and larger: Mineral fiber pre-formed pipe insulation: 1-1/2" thick.
- B. Condensate drains:
 1. All pipe sizes: Mineral fiber pre-formed pipe insulation: 1/2" thick.

3.8 EQUIPMENT 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.

3.9 TANK AND VESSEL INSULATION APPLICATION SCHEDULE

- A. Equipment: Domestic hot-water storage tanks, not factory insulated.
1. Operating Temperature: 55 to 140 deg F.
 2. Insulation Material: Mineral fiber.
 3. Insulation Thickness: 2"
 4. Field-Applied Jacket: Aluminum.
 - a. Aluminum Thickness: 0.032 inch.
 - b. Corrugation Dimension: 1-1/4 by 1/4 inch.
 5. Vapor Retarder Required: Yes.
 6. Finish: None.

END OF SECTION

SECTION 22 11 16

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 22 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes domestic water piping inside the building.
- B. Related Sections include the following:
 - 1. Division 22 Section 221119 "Domestic Water Piping Specialties" for water distribution piping specialties.

1.3 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Water Samples: Specified in Part 3 "Cleaning" Article.

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

- A. Refer to Part 3 "Pipe and Fitting Applications" Article for applications of pipe, tube, fitting, and joining materials.

- B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.3 COPPER TUBE AND FITTINGS

- A. Soft Copper Tube: ASTM B 88, Types K and L, hard-draw copper tube.
 - 1. Copper Fittings: ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
 - 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- B. Hard Copper Tube: ASTM B 88, Types L and M, hard-draw copper tube.
 - 1. Copper Fittings: ASME B16.22, wrought copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
 - 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.4 VALVES

- A. Bronze and cast-iron, general-duty valves are specified in Division 22 Section 220523 Section "General Duty Valves for Plumbing Piping".
- B. Balancing and drain valves are specified in Division 22 Section 221119 "Domestic Water Piping."

2.5 FLEXIBLE CONNECTORS

- A. Available Manufacturers:
 - 1. Hyspan Precision Products, Inc.
 - 2. Metraflex, Inc.
 - 3. Unaflex, Inc.
- B. Description: Corrugated, bronze inner tubing covered with bronze wired braid. Include copper-tube ends or bronze flanged ends, braze-welded to tubing. Include 125-psig minimum working-pressure rating and ends matching pump connections.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Excavating, trenching, and backfilling.

3.2 PIPE AND FITTING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
- B. Flanges may be used on aboveground piping, unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Domestic Water Piping inside the Building: Use the following piping materials for each size range:
- E. Under-Building-Slab, Domestic Water, Trap primer Piping on House Side of Water Meter, NPS 1 and Smaller: Soft copper tube, Type K.
- F. Above ground Domestic Water Piping: Use the following piping materials for each size range:
 - 1. NPS 4 and Smaller: Hard copper tube, Type L; wrought copper fittings ANSI B16.22; and solder joints type.
- G. Non-Potable-Water Piping: Use the following piping materials for each size range:
 - 1. NPS 3-1/2 and Smaller: Hard copper tube, Type L; wrought copper fittings ANSI B16.22; and solder joints type.
- H. Provide mechanical restraint joint for all gasketed water piping in lieu of thrust blocks.

3.3 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use bronze ball valves for piping NPS 2 and smaller. Use cast-iron butterfly or gate valves with flanged ends for piping NPS 2-1/2 and larger.
 - 2. Throttling Duty: Use bronze ball or globe valves for piping NPS 2 and smaller. Use cast-iron butterfly valves with flanged ends for piping NPS 2-1/2 and larger.
 - 3. Hot-Water-Piping, Balancing Duty: Calibrated, Memory-stop balancing valves.
 - 4. Drain Duty: Hose-end drain valves.
- B. Cast-iron, grooved-end valves may be used with grooved-end piping.

- C. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.
- D. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.
 - 1. Install hose-end drain valves at low points in water mains, risers, and branches.
 - 2. Install stop-and-waste drain valves where indicated.
- E. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Calibrated balancing valves are specified in Division 15 Section "Domestic Water Piping Specialties".

3.4 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing".
- B. Install under-building-slab copper tubing according to CDA's "Copper Tube Handbook."
- C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing".
- D. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Division 15 Section "Common Work Results for Plumbing".
- 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. Pressure gages are specified in Division 22 Section "General Duty Valves for Plumbing Piping", and drain valves and strainers are specified in Division 22 Section "Domestic Water Piping Specialties".
- F. Install domestic water piping level without pitch and plumb.

3.5 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing".
- B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

- C. Grooved Joints: Assemble joints with grooved-end-pipe or grooved-end-tube coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- D. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2144. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

3.6 WRAPPING FOR BURIED COPPER PIPING

- A. All buried copper pipe and fittings shall be cleaned then fully protected by wrapping with two separate wrappings (each half lapped) of 0.010x2 in. wide pressure sensitive polyvinyl tape. All fitting and joint wrapping shall overlap pipe wrapping a minimum of 2 in.
- B. Damage: Handle wrapped piping with extreme care to avoid damage. Repair marred or damaged pipe wrapping.

3.7 HANGER AND SUPPORT INSTALLATION

- A. Seismic-restraint devices are specified in Division 22 Section "Vibration & Seismic Controls for Plumbing Piping and Equipment".
- B. Pipe hanger and support devices are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment". Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet: MSS Type 49, spring cushion rolls, if indicated.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment"
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch.
- F. Install supports for vertical steel piping every 15 feet.

- G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
- H. Install supports for vertical copper tubing every 10 feet.

3.8 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow 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, and extend and connect to the following:
 - 1. Water Heaters: Cold-water supply 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 required by plumbing code. Refer to Division 22 Section "Plumbing Fixtures".
 - 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.

3.9 FIELD QUALITY CONTROL

- A. Inspect domestic water piping as follows:
 - 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - 2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

- b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
 3. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.
 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- B. Test domestic water piping as follows:
 1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
 6. Prepare reports for tests and required corrective action.

3.10 ADJUSTING

- A. Perform the following adjustments before operation:
 1. Close drain valves, 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 flow of hot water in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and plugs used 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 and non-potable domestic water piping as follows:
 1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as 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. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Prepare and submit reports of purging and disinfecting activities.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION

SECTION 22 11 19

PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. PLUMBING SPECIALTIES consists of furnishing transportation, labor, materials, and equipment to furnish and install the following plumbing specialties:

1. Backflow preventers.
2. Water pressure reducing valves.
3. Temperature-actuated water mixing valves.
4. Strainers.
5. Wall hydrants.
6. Drain valves.
7. Air vents.
8. Trap seal primer valves.
9. Miscellaneous piping specialties.
10. Access Panels.
11. Flashing materials.
12. Cleanouts.
13. Drains.
14. Water Hammer Arrestors.

1.2 RELATED WORK

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 22, apply to this Section.
- B. COMMON WORK RESULTS FOR PLUMBING Section 220500

1.3 REFERENCES

- A. American Water Works Association (AWWA)
- B. American Society of Testing and Materials (ASTM)

- C. American Society of Sanitation Engineers (ASSE)
- D. American Society of Mechanical Engineering (ASME)

1.4 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.
 - 3. Storm Drainage Piping: 10-foot head of water.

1.5 QUALITY ASSURANCE

- A. Codes and Standards:
 - 1. All governing Codes, Ordinances and Agencies, in accordance with the provisions of Division 1 of these specifications.
 - 2. Comply with NSF 61-G and California Lead Free Law for potable domestic water piping and components.

1.6 SUBMITTALS

- A. Product Data:
 - 1. Backflow preventers.
 - 2. Balancing valves and strainers.
 - 3. Water hammer arresters, air vents, and trap seal primer valves and systems.
 - 4. Hose bibbs.
 - 5. Cleanouts, floor drains, open receptors and roof drains.
 - 6. Vent caps, vent terminals, and roof flashing assemblies.
 - 7. Sleeve penetration systems.
- B. Operation and Maintenance Data:
 - 1. Backflow preventers.
 - 2. Trap seal primer valves and systems.
 - 3. Balancing Valves.
 - 4. Hose bibbs.

PART 2 - PRODUCTS

2.1 BACKFLOW PREVENTERS

- A. Manufacturers:
 - 1. Watts.
 - 2. Cla-Val Co.
 - 3. Zurn Industries, Inc.; Wilkins Div.
- B. General: ASSE standard, backflow preventers.
 - 1. NPS 2 and Smaller: Bronze body with threaded ends.
 - 2. NPS 2-1/2 and Larger: Bronze, cast-iron, steel, or stainless-steel body with flanged ends.
 - a. Interior Lining: AWWA C550 or FDA-approved, epoxy coating for backflow preventers having cast-iron or steel body.
 - 3. Interior Components: Corrosion-resistant materials.
 - 4. Exterior Finish: Polished chrome plate if used in chrome-plated piping system.
 - 5. Strainer: On inlet.
- C. Reduced-Pressure-Principle Backflow Preventers: ASSE 1013, suitable for continuous pressure application. Include ball valves on inlet and outlet, and strainer on inlet; test cocks; and pressure-differential relief valve with ASME A112.1.2 air-gap fitting Model AG-8 located below device. Wilkins Model 975. Pipe full size drain to nearest indirect waste receptor.

2.2 WATER PRESSURE-REDUCING VALVES

- A. 3 in. and smaller: Zurn Wilkins Model 500XLYSBR or equal, lead free, cast bronze body and covers, stainless steel seat, integral strainer with screen and seat, and stainless steel fasteners.

2.3 TEMPERATURE-ACTUATED WATER MIXING VALVES (MV-1)

- A. Lead free bronze body, integral check valves on hot and cold inlets, 0.5 gpm min. flow, 125 PSI max. pressure, ASSE 1017 certified. Leonard 270-LF or equivalent.

2.4 STRAINERS

- A. Strainers: Lead free Y-pattern, unless otherwise indicated, and full size of connecting piping. Include ASTM A 666, Type 304, stainless-steel screens with 3/64-inch round perforations, unless otherwise indicated. Wilkins model YBS-XL.

1. Pressure Rating: 125-psig minimum working pressure, unless otherwise indicated.
2. NPS 3 and Smaller: Bronze body, with female threaded ends.

2.5 WALL HYDRANTS

A. Wall Hydrants (HB-1):

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Woodford: Model 24P.
2. Standard: ASSE 1011.
3. Pressure Rating: 125 psig.
4. Operation: Wheel handle with loose key.
5. Inlet: NPS 3/4.

B. Wall Hydrants (HB-2):

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Woodford: Model B75.
2. Standard: ASSE 1011.
3. Pressure Rating: 125 psig.
4. Operation: Tee loose key.
5. Inlet: NPS 3/4.
6. Box and Cover Finish: Chrome.

C. Roof Hydrants (HB-3)

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Woodford, Model SRH-MS.
2. Pressure Rating: 100 psig.
3. Standard: ASSE 1057.
4. Inlet: NPT 3/4" no drain required.

2.6 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: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.7 WATER HAMMER ARRESTORS

A. Water Hammer Arrestors:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL, Inc.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. PPP Inc.
 - e. Sioux Chief Manufacturing Company, Inc.
 - f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - g. Tyler Pipe; Wade Div.
 - h. Watts Drainage Products Inc.
 - i. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Metal bellows.

4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.8 AIR VENTS

A. Bolted-Construction Automatic Air Vents:

1. Body: Bronze.
2. Pressure Rating: 125-psig minimum pressure rating at 140 deg. F.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 1/2 minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

B. Welded-Construction Automatic Air Vents:

1. Body: Stainless steel.
2. Pressure Rating: 150-psig minimum pressure rating.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 3/8 minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

2.9 TRAP SEAL PRIMER VALVES (TP-1)

A. Electronic and Piston Operated Trap Seal Primer Valves: ASSE 1018, electronic and pressure drop activated, with distribution unit as required.

1. Manufacturers:
 - a. TP-1: Precision Plumbing Products Model: Mini-Prime #MP-500-115V trap primer.
 - b. TP-1: Precision Plumbing Products Model: P-1 or P-2, or equal.
2. Provide for drains and floor sinks where trap primer is not provided from a water closet and as indicated and specified, each including trap primer valve, standpipe, and distribution unit(s) required for the specified distribution. Provide each concealed assembly with access panel, 8 in. by 8 inch size when distribution units are not required and 12 inches by 12 inches size when one or two distribution units are required. Provide trap primer piping same as specified for domestic water, including pipe wrapping.

2.10 MISCELLANEOUS PLUMBING SPECIALTIES

A. Access Panels:

1. Access Panels in Plaster Walls and Ceilings: Karp #DSC214PL, Elmdor PW, 24x24 in. with metal access door and frame, prime coated steel and painted to match adjacent surfaces. For fire rated areas use Karp #KRP-150 FR 1-1/2 hour "B" Label access panels, U.L. listed.
2. Access Panels in Acoustic Tile Ceilings: Karp #DSC-210, Elmdor AT, 24x24 in. with metal access door and frame, 24x24 in. minimum size, prime coated steel, recessed to accept standard tile in full opening door.
3. Access Panels in Ceramic Tile Walls: Karp #DSC214M, Smith 4730, chrome-plated cover and frame of suitable size for purpose intended, but not less than 8x8 in. size. For fire rated areas use Karp #FRP-150 FR 1-1/2 hour "B" Label access panels, U.L. listed.

B. Roof Flashing Assemblies: Manufactured assembly made of 4 pounds per square foot, 0.0625-inch- thick, one-piece lead flashing collar and skirt extending at least 6 inches from pipe with galvanized steel boot reinforcement, and counterflashing fitting.

1. Manufacturers:

- a. Semco Model 1100.

2. Low-Silhouette Vent Cap: With vandal-proof vent cap.

2.11 SLEEVE PENETRATION SYSTEMS

- A. Fire-rated wall and floor penetrations installed in conformance with manufacturers directions. Pro Set, Hilti, Nelson.
- B. Description: UL 1479, through-penetration firestop assembly through fire rated walls and floors.
- C. Provide at concrete or masonry exterior bearing walls, Adjust-to-Crete, Paramount, or Sperzel Cretesleeve. Wall sleeves shall be flush with finished surface. Sleeves shall be sized to allow 1/2 in. clearance around pipe or insulation. Insulation and covering shall be continuous through sleeves.
- D. At exterior walls below grade provide a modular mechanical seal consisting of interlocking EPDM rubber links shaped to continuously fill the annular space between the pipe and the wall opening with a molded high density polyethylene sleeve water-stop ring, end caps and reinforcing ribs. ASTM B117, ISO 9002. Mechanical seals shall be "Thunderline" Link Seal.

2.12 CLEANOUTS

- A. For cast-iron soil pipe, iron body with extra heavy bronze plugs screwed into caulking ferrules; for steel pipe, extra heavy bronze plugs; and for vitrified clay pipe, vitrified

clay plugs. Where cleanouts occur in finished interior walls, provide access panels, plates, and frames for flush mounting. Exposed parts of floor cleanouts shall have adjustable top. All cleanouts and cleanout plugs shall be accessible. Cleanout shall be the following:

1. In finished floors: Cast-iron with polished nickel bronze round top, non-skid diamond tread set flush with the floor. Provide with carpet marker when located in future carpeted areas and flashing flange when used with waterproofing membrane.
 - a. Smith - 4023
 - b. Wade - W-6000
 - c. Zurn - ZN-1420-2
2. In mechanical equipment areas: Cast-iron with heavy cast-iron round top, non-skid diamond tread set flush with the floor. Provide flashing flange when used with waterproofing membrane.
 - a. Smith - 4223
 - b. Wade - W-6000
 - c. Zurn - Z-1400
3. In walls: Cleanout tee with squared polished nickel bronze access plate with vandalproof screws and frames. Opening 8 inches by 8 inches minimum.
 - a. Smith - 4558-U
 - b. Wade - W-8460-S
 - c. Zurn - ZN-1447
4. In exterior grades: Cast-iron body, vandalproof cover, non-skid diamond tread, set flush with grade or finished surface. In non-surfaced area, they shall be cast in a concrete block 14 inches by 14 by 6 inches deep.
 - a. Smith - 4248
 - b. Wade - 6010-Z-75

2.13 FLOOR DRAINS AND FLOOR SINKS

A. Floor Drain (FD-1, FD-2): Foot traffic.

1. Cast-iron double drainage drain with clamping flange, bottom outlet and 5 inch round polished stainless steel adjustable strainer and trap primer tapping.
 - a. Smith - 2005-B

b. Zurn – Z-415

B. Floor Sink (FS-1)

1. 8-1/2 inch square, 6 inch deep acid-resisting enameled cast-iron drain with stainless steel rim and grate, sediment bucket and anchor flange with membrane clamp. Provide partial grate for discharge pipes and trap primer tapping.

a. Smith - 3140

b. Zurn – ZN-1910-K

2.14 ROOF DRAINS

A. Roof Drain (RD-1):

1. Cast-iron drain, adjustable extension sleeve, flashing collar, gravel stop cast-iron dome strainer, sump receiver and underdeck clamp.

a. Smith – 1010-ERC

b. Zurn – Z-100-ERC

B. Overflow Drain (OD-1):

1. Cast-iron drain, extension sleeve, flashing collar, 2 inch high water dam, cast-iron dome strainer, sumo receiver and underdeck clamp.

a. Smith – 1070-Y

b. Zurn – Z-100-W2

C. Roof Receptor (RR-1):

1. Cast-iron drain, extension sleeve, flashing collar, 2 in. high solid water dam, cast-iron bottom strainer, sump receiver and underdeck clamp.

a. Smith – 3980-Y

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to COMMON WORK RESULTS FOR PLUMBING Section 150500 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 as indicated on plans.

2. Install drain for backflow preventers with fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to receptor. 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 pressure regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.
 - D. Install strainers on supply side of each pressure regulator.
 - E. Install outlet boxes recessed in wall. Install 2 x 4 inch fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 6 Section "Rough Carpentry".
 - F. Install water hammer arrestors in water piping according to PDI-WH201.
 - G. Install air vents at high points of water piping.
 - H. Install 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.
 - I. Install cleanout deck plates with top flush with finished floor for floor cleanouts on piping below floors.
 - J. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.
 - K. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.
 - L. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.
 - M. Install drains at low points of surface areas to be drained as indicated on the architectural drawings. Set grates of drains flush with finished floor, unless otherwise indicated.
 - N. Install roof drains at low points of roof areas as indicated on the architectural Drawings.
 - O. 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.
 - P. Fasten recessed-type plumbing specialties to reinforcement built into walls.
 - Q. Install blocking reinforcement for wall-mounting and recessed-type plumbing specialties.

- R. Install individual shutoff valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve is not indicated. Install shutoff valves in accessible locations. See GENERAL-DUTY VALVES Section 150523 for general-duty ball, butterfly, check, gate, and globe valves.
- S. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 15 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 15 Sections.
- D. Connect plumbing specialties and devices that require power conforming to Division 15 Sections.

3.3 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.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Department maintenance personnel to adjust, operate, and maintain plumbing specialties.

3.5 FIELD QUALITY CONTROL

- A. Remove and replace malfunctioning domestic water piping specialties and retest.

3.6 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure reducing valves.
- B. Set field-adjustable temperature set points of temperature actuated water mixing valves.

END OF SECTION

SECTION 22 13 16

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions.

1.2 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.

1.3 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 in accordance with SMACNA Guidelines per Section 150548.

1.4 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.

1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
 - 1. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
 - a. Manufacturers:
 - 1) ABI
 - 2) Tyler
 - 3) Charlotte
- B. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
 - 1. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
 - a. Manufacturers:
 - 1) ANACO / Husky.
 - 2) Clamp - All
 - 3) Mission Rubber Co.
 - 4) Tyler Pipe; Soil Pipe Div.
 - 2. Heavy-Duty (4 and 6 band type), Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.
 - a. Manufacturers:
 - 1) ANACO / Husky 4000
 - 2) Clamp-All Corp - 80
 - 3) Mission Heavyweight
 - 4) Tyler Pipe; Soil Pipe Div.

5) Tyler Pipe; Soil Pipe Div.

2.4 ENCASEMENT FOR UNDERGROUND METAL PIPING

- A. Description: ASTM A 674 or AWWA C105, high-density, cross laminated PE film of 0.004-inch minimum thickness.
- B. Form: Tube.
- C. Color: Natural.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Refer to Division Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.
- B. Aboveground, soil waste and vent piping NPS 15 and smaller shall be the following:
 - 1. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings.
- C. Underground, soil, waste, and vent piping NPS 15 and smaller shall be the following:
 - 1. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings.

3.3 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Specification Section 22 05 00 "Common Work Results for Plumbing."
- B. Install seismic restraints on piping. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls For Plumbing Piping and Equipment."
- C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- D. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22.
- E. 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.

- F. 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.
- G. 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.
- H. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated on the drawings:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow.
 - 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.
- I. Install engineered soil and waste drainage and vent piping systems as follows:
 - 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
 - 2. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.
- J. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- K. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 15 Section "Common Work Results for Plumbing."
- B. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Seismic-restraint devices are specified in Division 15 Section "Mechanical Vibration Controls and Seismic Restraints."
- B. Pipe hangers and supports are specified in Division 15 Section "Hangers and Supports." Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Install individual, straight, horizontal piping runs according to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet, if indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Install supports according to Division 15 Section "Hangers and Supports."
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 - 4. NPS 6: 60 inches with 3/4-inch rod.
 - 5. NPS 8 to NPS 12: 60 inches with 7/8-inch rod.
 - 6. Spacing for 10-foot lengths may be increased to 10 feet.
- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Provide hangers or supports at each side of a no-hub fitting. Provide anti-separation bracing at each 90 degree change of direction of horizontal cast iron piping.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.

- B. Connect soil, and waste piping to exterior sanitary sewer 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.

3.7 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. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.
- 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.

3.8 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION

SECTION 22 33 00

ELECTRIC WATER HEATERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following electric water heaters:
 - 1. Commercial, storage electric water heaters.
 - 2. Compression tanks.
 - 3. Water heater accessories.
 - 4. Instantaneous Water Heater

1.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Commercial domestic-water heaters shall withstand the effects of earthquake motions determined according to SMACNA Guidelines.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified".

1.4 SUBMITTALS

- A. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Operation and Maintenance Data: For electric water heaters to include in emergency, operation, and maintenance manuals.
- C. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain same type of electric water heaters through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of electric water heaters and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. ASME Compliance: Where indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01.
- E. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for all components that will be in contact with potable water.
- F. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.6 COORDINATION

- A. Coordinate size and location of concrete bases with Architectural and Structural Drawings.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric water heaters that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including storage tank and supports.
 - b. Faulty operation of controls.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - 2. Warranty Period(s): From date of Substantial Completion:
 - a. Commercial Electric Water Heaters:
 - 1) Storage Tank: Three years.
 - 2) Controls and Other Components: Three years.
 - b. Compression Tanks: One year.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 COMMERCIAL ELECTRIC WATER HEATERS

- A. Commercial, Storage Electric Water Heaters: Comply with UL 1453 requirements for storage-tank-type water heaters.
 - 1. Manufacturers:
 - a. Bradford White Corporation.
 - b. Rheem
 - c. A.O. Smith.
 - 2. Storage-Tank Construction: Non-ASME-code, steel vertical arrangement, glass lined.
 - a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.
 - 1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
 - 2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - b. Pressure Rating: 150 psig.
 - c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
 - 3. Factory-Installed Storage-Tank Appurtenances:
 - a. Anode Rod: Extruded high density.
 - b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - c. Insulation: Comply with ASHRAE/IESNA 90.1.
 - d. Jacket: Steel with enameled finish.
 - e. Heating Elements: Medium watt density with zinc-plated copper sheath.
 - f. Temperature Control: Adjustable thermostat.
 - g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
 - h. Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3, for combination temperature and pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-

pressure rating. Select one relief valve with sensing element that extends into storage tank.

4. Special Requirements: NSF 5 construction.
5. Capacity and Characteristics:
 - a. As indicated on Plumbing Drawings.

2.3 COMPRESSION TANKS

- A. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
 1. Manufacturers:
 - a. AMTROL Inc.
 - b. Watts Regulator Co.
 - c. Wessels Co.
 2. Construction:
 - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1, pipe thread.
 - b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Air-Charging Valve: Factory installed.
 3. Capacity and Characteristics:
 - a. Working-Pressure Rating: 150 psig.
 - b. Capacity Acceptable: 2 gal. minimum.
 - c. Air Precharge Pressure: 55 psig.

2.4 WATER HEATER ACCESSORIES

- A. Combination Temperature and Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.
- B. Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include pressure setting less than water heater working-pressure rating.

- C. Water Heater Stands: Water heater manufacturer's factory-fabricated steel stand for floor mounting and capable of supporting water heater and water. Include dimension that will support bottom of water heater a minimum of 18 inches above the floor.
- D. Water Heater Restraint System: Heavy duty water heater seismic restraint system for wall mounting. Install per Manufacturer's direction and detail on plan.
- E. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of water heater and include drain outlet not less than NPS 3/4.

2.5 SOURCE QUALITY CONTROL

- A. Test and inspect water heater storage tanks, specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test water heater storage tanks before shipment to minimum of one and one-half times pressure rating.
- C. Prepare test reports.

2.6 INSTANTANEOUS WATER HEATERS

- A. Standard UL 499 for electric, tankless, (domestic water heater) heating appliance.
 - 1. Manufacturers:
 - a. Eemax
 - b. Chronomite
 - c. Stiebel Eltron
- B. Construction: Copper piping or tubing complying with NSF 61 Annex G barrier materials for potable water, without storage capacity.
 - 1. Connections: ASME B1.20.1 pipe thread.
 - 2. Pressure Rating: 150 psig
 - 3. Heating Element: Resistance heating system
 - 4. Temperature Control: Flow-control fitting
 - 5. Safety Control: High-temperature limit cut-off device or system
 - 6. Jacket: Aluminum or steel with enameled finish or plastic
- C. Support Bracket for Wall Mounting.

PART 3 EXECUTION

3.1 WATER HEATER INSTALLATION

- A. Install commercial water heaters on concrete bases.
 - 1. Exception: Omit concrete bases for commercial water heaters if installation on stand, bracket, suspended platform, or direct on floor is indicated.
 - 2. Concrete base construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
- C. Install seismic restraints for commercial water heaters. Anchor to substrate.
- D. Install 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 above floor sink.
- E. Install water-heater drain piping as indirect waste to spill by positive air gap over floor sinks. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 22 Section "Plumbing Specialties" for hose-end drain valves.
- F. Install thermometer on outlet piping of water heaters. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.
- G. Fill water heaters with water.
- H. Charge compression tanks with air.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.
- C. Ground equipment and connect wiring according to Division 26 Section "General Electrical Specification."

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial and instantaneous electric water heaters. Refer to Division 01 Section "Closeout Procedures, Demonstration and Training."

END OF SECTION

SECTION 22 40 00

PLUMBING FIXTURES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Plumbing fixtures consists of furnishing transportation, labor, materials, and equipment to furnish and install the following plumbing fixtures and related components:
1. Water closets.
 2. Lavatories.
 3. Sinks.
 4. Insulation kit.
 5. Drinking fountains with cooler.
 6. Mop sinks.
 7. Water hammer arrestors.
 8. Trap primers.
 9. Hose bibbs.
 10. Access panels.
- B. Accessible Fixtures, CBC 11B:
1. Accessible plumbing fixtures shall comply with all of the requirements of CBC Section 1115B.
 2. Heights and location of all fixtures shall be according to the CBC Section 1115B.4 and DSA Check List Figure 15-A.
 3. Fixture controls shall comply with CBC Sections 1115B.4.3, Item 1 for lavatories; Section 1115B.4.1, Item 5 toilets; and Section 1115B.4.2, Item 2 for urinals.
 4. 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. CBC Section 1117B.9, Item 2
- C. Performance, Cal Green – refer to table 5.303.3 on sheet P0.0:

1. Flush Valves: Flushometer valve type single flush with maximum volume of 1.28 gallons per flush (gpf) for water closets and 0.125 gallons per flush (gpf) for urinals.
2. Faucets: Public lavatories shall be equipped with faucets with a maximum flow of 0.5 gallons per minute (gpm). Kitchen faucets shall be equipped with a maximum flow rate of 1.8 gallons per minute (gpm).

1.2 REFERENCES

- A. American National Standards Institute:
 1. ANSI A117.1 – Accessible and Usable Buildings and Facilities
 2. ANSI Z358.1 – Emergency Eyewash and Shower Equipment
- B. Air Conditioning and Refrigeration Institute:
 1. ARI 1010 – Self-contained, Mechanically Refrigerated Drinking Water Coolers
- C. American Society of Mechanical Engineers
 1. ASME A112.6.1 – Floor-Affixed Supports for Off-the Floor Plumbing Fixtures for Public Use.
 2. ASME A112.18.1 - Plumbing Fixture Fittings.
 3. ASME A112.19.1M - Enameled Cast Iron Plumbing Fixtures.
 4. ASME A112.19.2M - Vitreous China Plumbing Fixtures.
 5. ASME A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use).
 6. ASME A112.19.4 - Porcelain Enameled Formed Steel Plumbing Fixtures.
 7. ASME A112.19.5 - Trim for Water-Closet Bowls, Tanks and Urinals.

1.3 RELATED DOCUMENTS

- A. COMMON WORK RESULTS FOR PLUMBING Section 220500
- B. JOINT PROTECTION Section 079000.
- C. EQUIPMENT WIRING CONNECTIONS Section 260503.
- D. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to this section.

1.4 DEFINITIONS

- A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- B. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.
- C. FRP: Fiberglass-reinforced plastic.
- D. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.5 SUBMITTALS

- A. Section 013300 – Submittal Procedures: Submittal Procedures
- B. Manufacturer's Literature: Submit brochures on all materials and equipment to the Engineer.
- C. Other Submittals:
 - 1. Shop Drawings.
 - 2. Sterilization Test Report.
 - 3. Test Data.
 - 4. Operations and Maintenance Manuals.
 - 5. Record Drawings.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
 - 1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Flush Valves: As specified; refer to plumbing fixture schedule.
- B. Plumbing Fixtures: As specified; refer to plumbing fixture schedule.
- C. Toilet Seats: Church, Beneke, Olsonite

- D. Faucets: As specified; refer to plumbing fixture schedule.

2.2 PLUMBING FIXTURES AND TRIMS

- A. Water Closet (WC-1): Wall mounted, ADA, flush valve.
1. Vitreous china, siphon jet action, elongated bowl, 1.28 gallon flush.
 2. American Standard 2856.128 "Madera"
 3. Solid plastic white open-front seat less cover: Bemis 1655CT.
 4. Flush Valve: Sloan Royal 111-1.28 flush valve 1.28 GPF.
- B. Lavatory (L-1): Wall-hung, A.D.A. Vitreous china, 20 x 18 in., concealed arms, 1 holes.
1. American Standard 0355.012 "Lucerne"
 2. Faucet: Chicago 3600-E39VPABABCP with 0.355 GPM flow, manual metering faucet with E3600-E39VPAB flow restrictor. Grid drain with chrome-plated tailpiece. Grid drain with chrome-plated tailpiece. Angle Stops and Supplies: Equivalent to McGuire LFH "lead-free" Series with solid flexible tube rises. Trap: Chrome-plated 17 gauge tubular brass "P" trap.
- C. Drinking Fountain (DF-1): Hi-low with bottler filler, vandal resistant
1. Elkay VRCTLDDWSK
 2. Provide with (1) GFCI Quad Receptacle
- D. Service Sink (SS-1): Floor-mounted.
1. Cast-iron acid-resisting enameled 28x28 in. with rim guard.
 2. American Standard 7741.000 "Florwell"
 3. Faucet: Chrome-plated, wall-mounted fitting with hose end, vacuum breaker, wall brace, bucket hook, integral stops, 2.5 GPM flow. Chicago Faucet 897-CP.

PART 3 - EXECUTION

3.1 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 cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
 - 1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
 - 2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
- C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.
- D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- E. Install wall-mounting fixtures with tubular waste piping attached to supports.
- F. Install counter-mounting fixtures in and attached to casework.
- G. Install fixtures level and plumb according to roughing-in drawings.
- H. 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.
- I. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- J. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- K. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- L. Install toilet seats on water closets.
- M. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- N. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
- O. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- P. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.

- Q. Install disposer in outlet of each sink indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.
- R. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings.
- S. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

3.4 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
- E. Install fresh batteries in sensor-operated mechanisms.

3.5 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Operate and adjust disposers. Replace damaged and malfunctioning units.
- C. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.
- D. Replace washers and seals of leaking and dripping faucets and stops.
- E. Install fresh batteries in sensor-operated mechanisms.

3.6 CLEANING

- A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
 - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
 - 2. Remove sediment and debris from drains.
- B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Engineer.

END OF SECTION

SECTION 23 05 00

COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Transition fittings.
 - 2. Dielectric fittings.
 - 3. Mechanical sleeve seals.
 - 4. Sleeves.
 - 5. Escutcheons.
 - 6. Grout.
 - 7. Equipment installation requirements common to equipment sections.
 - 8. Painting and finishing.
 - 9. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and 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 chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. CPVC: Chlorinated polyvinyl chloride plastic.
2. PE: Polyethylene plastic.
3. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

-
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.2 PAINTING

- A. Painting of HVAC systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

-
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.3 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.4 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC 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.

3.5 GROUTING

- A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION

SECTION 23 05 13

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.
- C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 105 deg F and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with

indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
 - 1. Motors 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 motors 7.5 HP and larger; rolled steel for motors 7.5 HP smaller than.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multi-speed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.

3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
1. Permanent-split capacitor.
 2. Split phase.
 3. Capacitor start, inductor run.
 4. Capacitor start, capacitor run.
- B. Multi-speed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Pre-lubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

- 1. Metal framing systems.
- 2. Equipment supports.

B. Related Sections:

- 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(s) "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - 3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - 1. Trapeze pipe hangers.
 - 2. Metal framing systems.
 - 3. Fiberglass strut systems.
 - 4. Pipe stands.
 - 5. Equipment supports.
- C. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 PRODUCTS

2.1 METAL 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. Thomas & Betts Corporation.
 - 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 intumed 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: Manufacturer's standard finish.
8. Plastic Coating: Plastic coating, jacket or liner.

2.2 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.3 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.
- D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- E. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled fiberglass struts.

- F. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- G. 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.
- H. 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 Division 07 Section "Roof Accessories" for curbs.
- I. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- J. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- K. 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.
- L. Install lateral bracing with pipe hangers and supports to prevent swaying.
- M. 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.
- N. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- O. 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.
- P. Insulated Piping:
 - 1. Attach clamps and spacers to piping.

- a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09.
- 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 PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Isolation pads.
 - 2. Isolation mounts.
 - 3. Restrained elastomeric isolation mounts.
 - 4. Freestanding and restrained spring isolators.
 - 5. Housed spring mounts.
 - 6. Spring hangers.
 - 7. Spring hangers with vertical-limit stops.
 - 8. Restrained vibration isolation roof-curb rails.
 - 9. Restraining braces and cables.

1.3 DEFINITIONS

- A. IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.
- C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
 - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated 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.
4. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
5. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
6. 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 Division 22 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).
- B. Coordination Drawings: Show coordination of seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints.
- C. Welding certificates.
- D. Qualification Data: For professional engineer and testing agency.
- E. Field quality-control test reports.

- F. Operation and Maintenance Data: For air-mounting systems to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
- B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 RESTRAINED VIBRATION ISOLATION ROOF-CURB

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. MicroMetl.
 - 2. M.W. Sausse & Company, Inc.
 - 3. Mason Industries.
- B. General Requirements for Restrained Vibration Isolation Roof-Curb Rails: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand seismic forces.
- C. Lower Support Assembly: Formed sheet-metal section containing adjustable and removable steel springs that support upper frame. Upper frame shall provide continuous support for equipment and shall be captive to resiliently resist seismic forces. Lower support assembly shall have a means for attaching to building structure and a wood nailer for attaching roof materials, and shall be insulated with a minimum of 2 inches of rigid, glass-fiber insulation on inside of assembly.

- D. Spring Isolators: Adjustable, restrained spring isolators shall be mounted on 1/4-inch-thick, elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.
1. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.
 - a. Housing: Steel with resilient vertical-limit stops and adjustable equipment mounting and leveling bolt.
 - b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - d. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 2. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
 - a. Resilient Material: Oil- and water-resistant natural rubber.
- E. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch thick.
- F. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.

2.2 SEISMIC-RESTRAINT DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. M.W. Sausse & Company, Inc.
 2. Mason Industries.
- B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- C. Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
 1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
 2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
 3. Maximum 1/4-inch air gap, and minimum 1/4-inch- thick resilient cushion.
- D. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
- E. Restraint Cables: ASTM A 603 galvanized-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.
- F. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.
- G. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.
- H. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.
- I. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
- J. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.
- K. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.5 FACTORY FINISHES

- A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

- B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
 - 1. Powder coating on springs and housings.
 - 2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
 - 3. Baked enamel or powder coat for metal components on isolators for interior use.
 - 4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Comply with requirements in Division 07 Section "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
- B. 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 providing required submittals for component.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.
- E. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- F. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- G. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- H. Drilled-in Anchors:
 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid pre-stressed tendons, electrical and telecommunications conduit, and gas lines.
 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 5. Set anchors to manufacturer's recommended torque, using a torque wrench.
 6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different

structural element from the one supporting the connections as they approach equipment.

3.5 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. Air-Mounting System Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 10. Air-Mounting System Operational Test: Test the compressed-air leveling system.
 - 11. Test and adjust air-mounting system controls and safeties.
 - 12. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.

3.6 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.

- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Adjust air-spring leveling mechanism.
- D. Adjust active height of spring isolators.
- E. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-mounting systems. Refer to demonstration and training requirements in Division 01 Section

END OF SECTION

SECTION 23 05 53

IDENTIFICATION FOR HVAC PIPING & EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Duct labels.
 - 4. Warning tags.

1.3 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.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel, as required to mount on equipment.
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 thick, and having predrilled holes for attachment hardware.
2. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
3. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
4. 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.
5. Fasteners: Stainless-steel, as required to mount on equipment.
6. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Black.
- C. Background Color: Yellow.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel, as required to mount equipment.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 DUCT LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Maximum Temperature: Able to withstand temperatures up to 160 deg. F.
- C. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
- D. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- E. Fasteners: Stainless-steel, as required to mount equipment.
- F. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- G. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.4 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.
 2. Fasteners: Brass grommet and wire.
 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 DUCT LABEL INSTALLATION

- A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:
 1. Green: For cold-air supply ducts.
 2. Yellow: For hot-air supply ducts.
 3. Blue: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
 4. ASME A13.1 Colors and Designs: For hazardous material exhaust.
- B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.4 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Balancing Air Systems:
 - a. Constant-volume air systems.
 - 2. Testing, Adjusting, and Balancing Equipment:
 - 3. Duct leakage tests.
 - 4. Control system verification.

1.3 DEFINITIONS

- A. Retain definition(s) remaining after this Section has been edited.
- B. AABC: Associated Air Balance Council.
- C. BAS: Building automation systems.
- D. NEBB: National Environmental Balancing Bureau.
- E. TAB: Testing, adjusting, and balancing.
- F. TABB: Testing, Adjusting, and Balancing Bureau.
- G. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
- H. TDH: Total dynamic head.

1.4 PREINSTALLATION MEETINGS

- A. TAB Conference: If requested by the Owner, conduct a TAB teleconference 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.

1.5 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.

1.6 QUALITY ASSURANCE

- A. TAB Specialists Qualifications: Certified by AABC.
 1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.

2. TAB Technician: Employee of the TAB specialist and certified by AABC as a TAB technician.
- B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."
- C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

1.7 FIELD CONDITIONS

- A. 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

3.1 TAB SPECIALISTS

- A. Subject to compliance with requirements, **available TAB specialists that may be engaged include, but are not limited to, the following:**
 1. National Air Balance Company, Inc.
 2. MESA3, Inc.
 3. Pacific Teat and Balance, Inc.

3.2 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 zone boxes, and verify that they are accessible and their controls are connected and functioning.
- K. Examine operating safety interlocks and controls on HVAC equipment.
- L. 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.

3.3 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.

3.4 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"** 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 233300 "Air Duct Accessories."
 - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in **inch-pound (IP)** units.

3.5 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. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

- D. 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.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check dampers for proper position to achieve desired airflow path.
- H. Check for airflow blockages.
- I. Check condensate drains for proper connections and functioning.
- J. Check for proper sealing of air-handling-unit components.
- K. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.6 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 **Architect** for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 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.

3.7 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.

3.8 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record fan and motor operating data.

3.9 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.

3.10 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.**

3.11 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 progress reports as requested by Architect to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.12 FINAL REPORT

- A. General: 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. Fan curves.
 - 2. Manufacturers' test data.
 - 3. Field test reports prepared by system and equipment installers.
 - 4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.
- C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB 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 zone boxes, 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 fan 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. Settings for exhaust-air, static-pressure controller.

- g. Other system operating conditions that affect performance.
- D. Air-Conditioning-Unit Test Reports: For air-conditioning units, 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. Number, make, and size of belts.
 - i. Number, type, and size of filters.
 - 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Filter static-pressure differential in inches wg.
 - e. Outdoor airflow in cfm.
 - f. Return airflow in cfm.
 - g. Outdoor-air damper position.

E. Apparatus-Coil Test Reports:

1. Coil Data:

- a. System identification.
- b. Number of rows.
- c. Fin spacing in **ins per inch** o.c.

2. Test Data (Indicated and Actual Values):

- a. Airflow rate in **cfm**.
- b. Average face velocity in **fpm**.
- c. Air pressure drop in **inches wg**.
- d. Outdoor-air, wet- and dry-bulb temperatures in **deg F**.
- e. Return-air, wet- and dry-bulb temperatures in **deg F**.
- f. Entering-air, wet- and dry-bulb temperatures in **deg F**.
- g. Leaving-air, wet- and dry-bulb temperatures in **deg F**.

F. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

- a. System identification.
- b. Location.
- c. Make and type.
- d. Model number and size.
- e. Manufacturer's serial number.
- f. Arrangement and class.
- g. Sheave make, size in **inches**, and bore.

2. Motor Data:

- a. Motor make, and frame type and size.
- b. Horsepower and rpm.
- c. Volts, phase, and hertz.

- d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Number, make, and size of belts.
 - 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Suction static pressure in inches wg.
- G. 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-conditioning-unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F.
 - d. Duct static pressure in inches wg.
 - e. Duct size in inches
 - f. Duct area in sq. ft.
 - g. Indicated airflow rate in cfm.
 - h. Actual airflow rate in cfm.
 - i. Actual average velocity in fpm.
 - j. Barometric pressure in psig.
- H. Zone Box-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.**.
- 2. Test Data (Indicated and Actual Values):
 - a. Airflow rate in **cfm**.
 - b. Air velocity in **fpm**.
 - c. Final airflow rate in **cfm**.
 - d. Final velocity in **fpm**.
 - e. Space temperature in **deg F**.
- I. Instrument Calibration Reports:
 - 1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.13 VERIFICATION OF TAB REPORT

- A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Construction Manager and Commissioning Cx Agent. TAB contractor shall make adjustments to the system(s) as required to attain the design air flows.
- B. Architect and/or Engineer shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 20 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 and/or Engineer may contact AABC Headquarters regarding the AABC National Performance Guaranty.
- F. Prepare test and inspection reports.

3.14 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 00

HVAC INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01, 09, and 23 Specification Sections, apply to this Section.
 - 1. Related Sections include the following:
 - 2. Section 23 31 13 - Metal Ducts.

1.2 SUMMARY

- A. Section Includes:
 - 1. Insulation Materials:
 - a. Cellular glass, glass fiber.
 - b. Mineral fiber.
 - c. Polyolefin.
 - 2. Lagging adhesives.
 - 3. Sealants.
 - 4. Factory-applied jackets.
 - 5. Field-applied jackets.
 - 6. Tapes.
 - 7. Securements.
 - 8. Corner angles.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).
- B. Shop Drawings:
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.

2. Detail insulation application at pipe expansion joints for each type of insulation.
 3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 4. Detail removable insulation at piping specialties, equipment connections, and access panels.
 5. Detail application of field-applied jackets.
 6. Detail application at linkages of control devices.
 7. Detail field application for each equipment type.
- C. Qualification Data: For qualified Installer.
- D. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- E. Field quality-control reports.

1.4 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.

1.5 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.

1.6 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Section 230529 - Hangers and Supports for HVAC Piping and Equipment.
- B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Pittsburgh Corning
- B. Certain-teed, Green Guard
- C. Johns Manville
- D. Knauf

2.2 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type."
- G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 795, Type I or Type II. For duct and plenum applications, provide insulation. For equipment applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.3 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. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F.
 - 1. Products:
 - a. Childers Products, Division of ITW; CP-97.
 - b. Foster Products Corporation, H. B. Fuller Company; 81-27/81-93.
 - c. Marathon Industries, Inc.; 290.
 - d. Mon-Eco Industries, Inc.; 22-30.
 - e. Vimasco Corporation; 760.
 - 2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Cellular-Glass, Phenolic, Polyisocyanurate, and Polystyrene Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.
 - 1. Products:
 - a. Childers Products, Division of ITW; CP-96.
 - b. Foster Products Corporation, H. B. Fuller Company; 81-33.
 - 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. PVC Jacket Adhesive: Compatible with PVC jacket.
 - 1. Products:
 - a. Dow Chemical Company (The); 739, Dow Silicone.
 - b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. P.I.C. Plastics, Inc.; Welding Adhesive.
 - d. Speedline Corporation; Speedline Vinyl Adhesive.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
 1. For indoor applications, use mastics that have a VOC content of 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 and outdoor use on below ambient services.
 1. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
 2. Service Temperature Range: Minus 20 to plus 180 deg F.
 3. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
 4. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.
 1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
 2. Service Temperature Range: 0 to 180 deg F.
 3. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
 4. Color: White.
- D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.
 1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
 2. Service Temperature Range: Minus 50 to plus 220 deg F.
 3. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
 4. Color: White.
- E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
 1. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
 2. Service Temperature Range: Minus 20 to plus 200 deg F.

3. Solids Content: 63 percent by volume and 73 percent by weight.
4. Color: White.

2.5 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 Subpart D (EPA Method 24).
 2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.
 3. Service Temperature Range: Minus 50 to plus 180 deg F.
 4. Color: White.

2.6 SEALANTS

- A. Joint Sealants:
 1. Joint Sealants for Cellular-Glass, Products:
 - a. Childers Products, Division of ITW; CP-76.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-45.
 - c. Marathon Industries, Inc.; 405.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Pittsburgh Corning Corporation; Pittseal 444.
 - f. Vimasco Corporation; 750.
 2. Color: White or gray.
 3. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. FSK and Metal Jacket Flashing Sealants:
 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 2. Fire- and water-resistant, flexible, elastomeric sealant.
 3. Service Temperature Range: Minus 40 to plus 250 deg F.
 4. Color: Aluminum.

5. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
 2. Fire- and water-resistant, flexible, elastomeric sealant.
 3. Service Temperature Range: Minus 40 to plus 250 deg F.
 4. Color: White.
 5. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.7 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.
 4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
 5. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
 - a. Products:
 - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
 6. PVDC Jacket for Outdoor Applications: 6-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
 - a. Products:
 - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

7. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.
8. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with Kraft-paper backing.
- C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 1. Adhesive: As recommended by jacket material manufacturer.
 2. Color: Color as selected by Project Manager.
 3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
 4. Factory-fabricated tank heads and tank side panels.
- D. Metal Jacket:
 1. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.
 - a. Factory cut and rolled to size.
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Indoor Applications: 3-mil- thick, heat-bonded polyethylene and Kraft paper.
 - d. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and Kraft paper.
 - e. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.

- 3) Tee covers.
 - 4) Flange and union covers.
 - 5) End caps.
 - 6) Beveled collars.
 - 7) Valve covers.
 - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
- E. Self-Adhesive Outdoor Jacket: 60-mil- thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a cross-laminated polyethylene film covered with white aluminum-foil facing.
- F. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
- G. PVDC Jacket for Outdoor Applications: 6-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
- H. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

2.9 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Products:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
 - b. Compac Corp.; 104 and 105.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
 2. Width: 3 inches.
 3. Thickness: 11.5 mils.
 4. Adhesion: 90 ounces force/inch in width.

5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. Width: 3 inches.
 2. Thickness: 6.5 mils.
 3. Adhesion: 90 ounces force/inch in width.
 4. Elongation: 2 percent.
 5. Tensile Strength: 40 lbf/inch in width.
 6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
1. Products:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
 - b. Compac Corp.; 130.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
 - d. 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.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Width: 2 inches.
 2. Thickness: 3.7 mils.
 3. Adhesion: 100 ounces force/inch in width.

4. Elongation: 5 percent.
 5. Tensile Strength: 34 lbf/inch in width.
- E. PVDC Tape for Indoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.
1. Width: 3 inches.
 2. Film Thickness: 4 mils.
 3. Adhesive Thickness: 1.5 mils.
 4. Elongation at Break: 145 percent.
 5. Tensile Strength: 55 lbf/inch in width.
- F. PVDC Tape for Outdoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.
1. Width: 3 inches.
 2. Film Thickness: 6 mils.
 3. Adhesive Thickness: 1.5 mils.
 4. Elongation at Break: 145 percent.
 5. Tensile Strength: 55 lbf/inch in width.

2.10 SECUREMENTS

- A. Bands:
1. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing or closed seal.
 2. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.
- B. Insulation Pins and Hangers:
1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated.
 - a. Products:
 - 1) AGM Industries, Inc.; CWP-1.
 - 2) GEMCO; CD.

- 3) Midwest Fasteners, Inc.; CD.
 - 4) Nelson Stud Welding; TPA, TPC, and TPS.
2. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
- a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - b. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
3. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
- a. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1 ½ inches in diameter.
 - b. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2 ½ inches.
 - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
4. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
- a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - b. Spindle: Aluminum fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 - c. Adhesive-backed base with a peel-off protective cover.
5. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, aluminum sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1 ½ inches in diameter.
- a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- D. Wire: 0.080-inch nickel-copper alloy.

2.11 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
- B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
 - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1 ½ 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.
 - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Manholes.
 - 5. Handholes.
 - 6. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor

- insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
1. Comply with requirements in Section 07 81 16 - Cementitious Fireproofing, Section 07 81 23 - Intumescent Mastic Fireproofing, Section 07 84 00 - Fire Stopping.
- F. Insulation Installation at Floor Penetrations:
1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
 2. Pipe: Install insulation continuously through floor penetrations.
 3. Seal penetrations through fire-rated assemblies. Comply with requirements in Sections 07 81 23 - Intumescent Mastic Fireproofing and 07 84 00 - Fire Stopping.

3.5 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
 2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
 3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where FSK jackets are indicated, install as follows:
1. Draw jacket material smooth and tight.
 2. Install lap or joint strips with same material as jacket.
 3. Secure jacket to insulation with manufacturer's recommended adhesive.

4. Install jacket with 1 ½ inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.6 FINISHES

- A. Duct, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.
1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Color: Final color as selected by Construction Manager. Vary first and second coats to allow visual inspection of the completed Work.
- C. Do not field paint aluminum or stainless-steel jackets.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation: 2 inches thick with vapor barrier jacket.
 - 1. Indoor, concealed supply and outdoor air, 2 inches thick with vapor barrier jacket.
 - 2. Indoor, exposed supply and outdoor air, 2 inches thick with vapor barrier jacket.
 - 3. Indoor, concealed return located in nonconditioned space, 1½ inch thick with vapor barrier jacket.
 - 4. Indoor, exposed return located in nonconditioned space, 2 inch thick with vapor barrier jacket.
 - 5. Outdoor, concealed supply and return 2 inch thick liner.
 - 6. Outdoor, exposed supply and return, 2 inch thick liner.
- B. Items Not Insulated:
 - 1. Fibrous-glass ducts.
 - 2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
 - 3. Factory-insulated flexible ducts.
 - 4. Factory-insulated plenums and casings.
 - 5. Flexible connectors.
 - 6. Vibration-control devices.
 - 7. Factory-insulated access panels and doors.

3.9 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, round and flat-oval, supply-air and return air duct insulation shall be the following:
 - 1. Mineral-Fiber Board or Blanket: 2 inches thick and 3-lb/cu. ft. nominal density.
- B. Concealed, return-air plenum insulation shall be the following:
 - 1. Mineral-Fiber Board or Blanket: 1½ inches thick and 3-lb/cu. ft. nominal density.

3.10 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. Exposed, round and rectangular, supply-air and return-air duct insulation shall be the following:
 - 1. Duct liner: 2 inches thick and 3-lb/cu. ft. nominal density.

3.11 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Ducts and Plenums, Concealed and Exposed:
 - 1. Painted Aluminum, Smooth 0.032 inch thick.

END OF SECTION

SECTION 23 31 13

METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Double-wall rectangular ducts and fittings.
3. Single-wall round and flat oval ducts and fittings.
4. Sheet metal materials.
5. Duct liner.
6. Sealants and gaskets.
7. Hangers and supports.
8. Seismic-restraint devices.

B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

- A. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 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. 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.
- D. Welding certificates.
- E. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."
- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND 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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. McGill AirFlow LLC.
 - b. SEMCO Incorporated.
- 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 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 in diameter with butt-welded longitudinal seams.
 - 2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
- 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."

2.3 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60.
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. 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.
- E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 DUCT LINER

- A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. CertainTeed Corporation; Insulation Group.
 - b. Johns Manville.
 - c. Knauf Insulation.
 - d. Owens Corning.
 - 1) Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 - 2) Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 3. 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.
 4. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
 - a. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

- b. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Insulation Pins and Washers:
 - 1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
 - 2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."
 - 1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
 - 2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
 - 3. Butt transverse joints without gaps, and coat joint with adhesive.
 - 4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
 - 5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
 - 6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
 - 7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
 - 8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
 - a. Fan discharges.
 - b. Intervals of lined duct preceding unlined duct.

- c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.
- 9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
 - a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.
- 10. Terminate inner ducts with build outs attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated build outs (metal hat sections) or other build out means are optional; when used, secure build outs to duct walls with bolts, screws, rivets, or welds.

2.5 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
 - 1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
 - 2. Tape Width: 4 inches.
 - 3. Sealant: Modified styrene acrylic.
 - 4. Water resistant.
 - 5. Mold and mildew resistant.
 - 6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 - 7. Service: Indoor and outdoor.
 - 8. Service Temperature: Minus 40 to plus 200 deg F.
 - 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
 - 10. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
9. VOC: Maximum 395 g/L.
10. 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."
11. Maximum Static-Pressure Class: 10-inch wg , positive or negative.
12. Service: Indoor or outdoor.

13. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- E. 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, use sealant that has 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."
- F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- G. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
 2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
 3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.6 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 , "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

- F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.7 SEISMIC-RESTRAINT DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hilti Corp.
 - 2. Mason Industries.
 - 3. TOLCO; a brand of NIBCO INC.
- B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by 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-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 support systems to hanger rod.
- F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round and flat oval ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Where tap-ins are used to connect to ductwork or plenums, use 45-degree shoe taps at rectangular duct and conical taps at round duct.
- F. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- G. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- H. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- I. Install ducts with a clearance of 1 inch , plus allowance for insulation thickness.
- J. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- K. 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.
- L. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.
- M. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 2. Outdoor, Supply-Air Ducts: Seal Class A.
 - 3. Outdoor, Exhaust Ducts: Seal Class C.
 - 4. Outdoor, Return-Air Ducts: Seal Class C.
 - 5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
 - 6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
 - 7. Unconditioned Space, Exhaust Ducts: Seal Class C.
 - 8. Unconditioned Space, Return-Air Ducts: Seal Class B.
 - 9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
 - 10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
 - 11. Conditioned Space, Exhaust Ducts: Seal Class B.
 - 12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
 - 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 SEISMIC-RESTRAINT-DEVICE INSTALLATION

- A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."
- 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 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 pre-stressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - 5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.6 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

3.8 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. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
3. Test for leaks before applying external insulation.
4. 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.
5. 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.

3.9 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 Division 23 Section "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 Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.11 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel.
- B. Supply Ducts:
 - 1. Ducts Connected to gas/electric A.C. units:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 24.
- 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.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 24.
- D. Exhaust Ducts:
 - 1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
 - a. Pressure Class: Negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: C if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 24.
 - 2. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.
 - a. Exposed to View: Type 304, stainless-steel sheet, No. 4 finish.
 - b. Concealed: Type 304, stainless-steel sheet, No. 2D finish.
 - c. Welded seams and joints.
 - d. Pressure Class: Positive or negative 3-inch wg.

- e. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
 - f. SMACNA Leakage Class: 3.
- E. Intermediate Reinforcement:
- 1. Galvanized-Steel Ducts: 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: Match duct material.
 - 3. Stainless-Steel Ducts:
 - a. Exposed to Airstream: Match duct material.
 - b. Not Exposed to Airstream: Match duct material.
 - 4. Aluminum Ducts: Aluminum or galvanized sheet steel coated with zinc chromate.
- F. Liner:
- 1. Supply Air Ducts: Fibrous-glass, 2 inches thick.
 - 2. Return Air Ducts: Fibrous-glass, 2 inches thick.
 - 3. Supply Fan Plenums: Fibrous-glass, 2 inches thick.
 - 4. Return- and Exhaust-Fan Plenums: Fibrous-glass, 2 inches thick.
- G. Elbow Configuration:
- 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Velocity 1000 fpm or Lower:
 - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
 - 2) Mitered Type RE 4 without vanes.
 - b. Velocity 1000 to 1500 fpm :
 - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.

- 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 - c. Velocity 1500 fpm or Higher:
 - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
 - 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
 - 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
 - 4) Radius-to Diameter Ratio: 1.5.
 - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
 - c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

H. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: Spin in.
2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
 - a. Velocity 1000 fpm or Lower: 90-degree tap.
 - b. Velocity 1000 to 1500 fpm: Conical tap.
 - c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Backdraft and pressure relief dampers.
 - 2. Barometric relief dampers.
 - 3. Manual volume dampers.
 - 4. Flange connectors.
 - 5. Turning vanes.
 - 6. Remote damper operators.
 - 7. Duct-mounted access doors.
 - 8. Flexible connectors.
 - 9. Flexible ducts.
 - 10. Duct accessory hardware.
 - 11. Duct silencers.
- B. Related Sections:
 - 1. Division 23 Section "HVAC Gravity Ventilators" for roof-mounted ventilator caps.
 - 2. Division 28 Section "Fire Detection and Alarm" for duct-mounted fire and smoke detectors.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. For duct silencers, include the following:

- a. Catalog information indicating, pressure drop, dynamic insertion loss data, and self-generated noise levels.
 - b. Test Reports: Indicate dynamic insertion loss and noise generation values of silencers, and static pressure drop for the specified air velocity.
 - c. Manufacturer's Installation Instructions: Indicate installation requirements, which maintain integrity of sound isolation.
- B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
 - 1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings.
 - b. Manual volume damper installations.
 - c. Control damper installations.
 - d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
 - e. Duct security bars.
 - f. Wiring Diagrams: For power, signal, and control wiring.
- C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.
- D. Source quality-control reports.
- E. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with AMCA 500-D testing for damper rating.

1.5 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. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - EXECUTION

2.1 MATERIALS

- A. 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: [G60] [G90].
 2. Exposed-Surface Finish: Mill phosphatized.
- C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304.
- D. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- E. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.
- F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches .

2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- 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. Air Balance Inc.; a division of Mestek, Inc.
 2. Greenheck Fan Corporation.
 3. Pottorff; a division of PCI Industries, Inc.
 4. Ruskin Company.
- B. Description: Gravity balanced.
- C. Maximum Air Velocity: 2000 fpm.
- D. Maximum System Pressure: 2-inch wg.
- E. Frame: 0.052-inch- thick, galvanized sheet steel, with welded corners.

- F. Blades: Multiple single-piece blades, maximum 6-inch width, 0.025-inch-thick, roll-formed aluminum with sealed edges.
- G. Blade Action: Parallel.
- H. Blade Seals: Extruded vinyl, mechanically locked or Neoprene, mechanically locked.
- I. Blade Axles:
 - 1. Material: Galvanized steel.
 - 2. Diameter: 0.20 inch.
- J. Tie Bars and Brackets: Galvanized steel.
- K. Return Spring: Adjustable tension.
- L. Accessories:
 - 1. Adjustment device to permit setting for varying differential static pressure.
 - 2. Counterweights and spring-assist kits for vertical airflow installations.
 - 3. Electric actuators.
 - 4. Chain pulls.
 - 5. Screen Mounting: Front mounted in sleeve.
 - a. Sleeve Thickness: 20-gage minimum.
 - b. Sleeve Length: 6 inches minimum.
 - 6. Screen Mounting: Rear mounted.
 - 7. Screen Material: Galvanized steel.
 - 8. Screen Type: Bird.
 - 9. 90-degree stops.

2.3 BAROMETRIC RELIEF DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Air Balance Inc.; a division of Mestek, Inc.
 - 2. Greenheck Fan Corporation.
 - 3. Pottorff; a division of PCI Industries, Inc.
 - 4. Ruskin Company.

- B. Suitable for horizontal or vertical mounting.
- C. Maximum Air Velocity: 2000 fpm.
- D. Maximum System Pressure: 2-inch wg.
- E. Frame: 0.064-inch- thick, galvanized sheet steel, with welded corners.
- F. Blades:
 - 1. Multiple, 0.025-inch-thick, roll-formed aluminum.
 - 2. Maximum Width: 6 inches.
 - 3. Action: Parallel.
 - 4. Balance: Gravity.
 - 5. Eccentrically pivoted.
- G. Blade Seals: Vinyl or Neoprene.
- H. Blade Axles: Galvanized steel.
- I. Tie Bars and Brackets:
 - 1. Material: Galvanized steel.
 - 2. Rattle free with 90-degree stop.
- J. Return Spring: Adjustable tension.
- K. Accessories:
 - 1. Flange on intake.
 - 2. Adjustment device to permit setting for varying differential static pressures.

2.4 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Air Balance Inc.; a division of Mestek, Inc.
 - b. Pottorff; a division of PCI Industries, Inc.
 - c. Ruskin Company.
 - 2. Standard leakage rating, with linkage outside airstream.

3. Suitable for horizontal or vertical applications.
 4. Frames:
 - a. Hat-shaped, galvanized, 0.064-inch minimum thickness.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
 5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized-steel, 0.064 inch thick.
 6. Blade Axles: Galvanized steel.
 7. Bearings:
 - a. Oil-impregnated bronze.
 - b. Dampers in ducts with pressure classes of 3-inch wg. or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 8. Tie Bars and Brackets: Galvanized steel.
- B. Low-Leakage, Steel, Manual Volume Dampers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Air Balance Inc.; a division of Mestek, Inc.
 - b. Pottorff; a division of PCI Industries, Inc.
 - c. Ruskin Company.
 2. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
 3. Suitable for horizontal or vertical applications.
 4. Frames:
 - a. Hat shaped.
 - b. Galvanized-steel channels, 0.064 inch thick.
 - c. Mitered and welded corners.

- d. Flanges for attaching to walls and flangeless frames for installing in ducts.
- 5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized, roll-formed steel, 0.064 inch thick.
- 6. Blade Axles: Galvanized.
- 7. Bearings:
 - a. Oil-impregnated bronze.
 - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
- 8. Blade Seals: Vinyl or Neoprene.
- 9. Jamb Seals: Cambered stainless steel.
- 10. Tie Bars and Brackets: Galvanized steel.
- 11. Accessories:
 - a. Include locking device to hold single-blade dampers in a fixed position without vibration.
- C. Jackshaft:
 - 1. Size: 1-inch diameter.
 - 2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
 - 3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.
- D. Damper Hardware:
 - 1. 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.
 - 2. Include center hole to suit damper operating-rod size.
 - 3. Include elevated platform for insulated duct mounting.

2.5 FLANGE CONNECTORS

- 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. Ductmate Industries, Inc.
 - 2. Nexus PDQ; Division of Shilco Holdings Inc.
 - 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

2.6 TURNING VANES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
 - 1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."
- E. Vane Construction: Double wall.
- F. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.7 DUCT-MOUNTED ACCESS DOORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Greenheck Fan Corporation.

3. Pottorff; a division of PCI Industries, Inc.
- B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."
 1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Vision panel.
 - d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
 - e. Fabricate doors airtight and suitable for duct pressure class.
 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
 3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
 - c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
 - d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

2.8 FLEXIBLE CONNECTORS

- 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. Ductmate Industries, Inc.
 2. Duro Dyne Inc.
 3. Ventfabrics, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd. .
 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 3. Service Temperature: Minus 40 to plus 200 deg F.
- F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
1. Minimum Weight: 24 oz./sq. yd. .
 2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
 3. Service Temperature: Minus 50 to plus 250 deg. F.
- G. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.
1. Minimum Weight: 16 oz./sq. yd.
 2. Tensile Strength: 285 lbf/inch in the warp and 185 lbf/inch in the filling.
 3. Service Temperature: Minus 67 to plus 500 deg. F.
- H. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.
1. Minimum Weight: 14 oz./sq. yd.
 2. Tensile Strength: 450 lbf/inch in the warp and 340 lbf/inch in the filling.
 3. Service Temperature: Minus 67 to plus 500 deg. F.
- I. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.
1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
 2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.

7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

2.9 FLEXIBLE DUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Casco Silentflex II.
- B. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.
 1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
 2. Maximum Air Velocity: 4000 fpm.
 3. Temperature Range: Minus 20 to plus 175 deg F.
 4. Insulation R-Value: Comply with Title 24.

2.10 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.11 DUCT SILENCER

- A. Manufacturers:
 1. Vibro-Acoustics.
 2. Commercial Acoustics.
 3. Industrial Acoustics Company (IAC).
- B. General Description: Factory-fabricated and -tested, round or rectangular silencers with performance characteristics and physical requirements as indicated.
- C. Acoustics Performance Requirements:
 1. The dynamic insertion loss in dB for silencers shall not be less than that shown on the Duct Silencer Schedule, or Drawings, at the face air velocity of +1,000 fpm (+ indicates airflow in the same direction as attenuation).
 2. Duct silencers shall not produce self-noise power levels in dB re 10^{-12} watts that exceed those shown on the Duct Silencer Schedule.
 3. Duct silencers static pressure drop shall not exceed those indicated on the duct silencer schedule for the scheduled airflow velocity and location shown.

- C. Fire Performance: Adhesives, sealants, packing materials, and accessory materials shall have fire ratings not exceeding 25 for flame-spread index and 50 for smoke-developed index when tested according to ASTM E 84, NFPA 255 and UL 723.
- D. Rectangular Units: Fabricate casings with a minimum of 0.034-inch- thick, solid galvanized sheet metal for outer casing and 0.022-inch- thick, ASTM A 653/A 653M, G60, perforated galvanized sheet metal for inner casing.
- E. F. Sheet Metal Perforations: 1/8-inch diameter for inner casing and baffle sheet metal.
- G. Fill Material: Inert and vermin-proof fibrous material, packed under not less than 5 percent compression.
 - 1. Erosion Barrier: Polymer bag enclosing fill and heat-sealed before assembly.
- H. Fabricate silencers to form rigid units that will not pulsate, vibrate, rattle, or otherwise react to system pressure variations.
 - 1. Do not use nuts, bolts, or sheet metal screws for unit assemblies.
 - 2. Lock form and seal or continuously weld joints.
 - 3. Suspended Units: Factory-installed suspension hooks or lugs attached to frame in quantities and spaced to prevent deflection or distortion.
 - 4. Reinforcement: Cross or trapeze angles for rigid suspension.
- I. Source Quality Control:
 - 1. Acoustic Performance: Test according to ASTM E 477.
 - 2. Record acoustic ratings, including dynamic insertion loss and self-noise power levels with an airflow of at least 1000-fpm face velocity.
 - 3. Leak Test: Test units for airtightness at 200 percent of associated fan static pressure or 6-inch wg static pressure, whichever is greater.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 - 1. Install steel volume dampers in steel ducts.
 - 2. Install aluminum volume dampers in aluminum ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install fire and smoke dampers according to UL listing.
- H. Connect ducts to duct silencers with flexible duct connectors.
- I. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. On both sides of duct coils.
 - 2. Downstream from duct filters.
 - 3. At outdoor-air intakes and mixed-air plenums.
 - 4. At drain pans and seals.
 - 5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
 - 6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 - 7. At each change in direction and at maximum 50-foot spacing.
 - 8. Downstream from turning vanes.
 - 9. Upstream or downstream from duct silencers.
 - 10. Control devices requiring inspection.
 - 11. Elsewhere as indicated.
- J. Install access doors with swing against duct static pressure.
- K. Access Door Sizes:
 - 1. One-Hand or Inspection Access: 8 by 5 inches.

2. Two-Hand Access: 12 by 6 inches.
 3. Head and Hand Access: 18 by 10 inches.
 4. Head and Shoulders Access: 21 by 14 inches.
 5. Body Access: 25 by 14 inches.
 6. Body plus Ladder Access: 25 by 17 inches.
- L. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- M. Install flexible connectors to connect ducts to equipment.
- N. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- O. Connect terminal units to supply ducts directly or with maximum 84-inch lengths of flexible duct. Do not use flexible ducts to change directions.
- P. Connect diffusers or light troffer boots to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.
- Q. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.
- R. Install duct test holes where required for testing and balancing purposes.
- S. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.
- T. All equipment and components requiring access above hardlid ceiling shall be provided with adequate service clearance and ceiling access panels. Coordinate ceiling access panel location based upon installation location in field and in accordance with Section 08 31 00 – Access Doors and Panels.
- U. Do not locate duct silencers within one duct diameter from fan discharge/intake openings, elbows, or takeoffs.

3.2 FIELD QUALITY CONTROL

- V. Tests and Inspections:
1. Operate dampers to verify full range of movement.
 2. Inspect locations of access doors and verify that purpose of access door can be performed.
 3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.

4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION

SECTION 23 34 23

HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Ceiling mounted ventilators.

1.3 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base fan-performance ratings on actual Project site elevations.
- B. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:
 - 1. Certified fan performance curves with system operating conditions indicated.
 - 2. Certified fan sound-power ratings.
 - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 4. Material thickness and finishes, including color charts.
 - 5. Dampers, including housings, linkages, and operators.
 - 6. Fan speed controllers.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring Diagrams: For power, signal, and control wiring.
- C. 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.
- D. Field quality-control reports.
- E. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.5 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.
- D. Fan shall be manufactured at an ISO 9001 certified facility.

1.6 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.

1.7 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

2.1 CEILING-MOUNTED VENTILATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Greenheck Fan Corporation.
 2. Loren Cook Company.
 3. Twin City
- B. These units are factory assembled with one or more centrifugal wheels up to 12 inches wide, directly connected to motor, enclosed in housing, with inlet grille and integral backdraft damper; AMCA rated.

- C. Housing: Steel, lined with acoustical insulation.
- D. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.
- E. Grille: Plastic, louvered grille with flange on intake and thumbscrew attachment to fan housing.
- F. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.
- G. Accessories:
 - H. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
 - 1. Manufacturer's standard roof cap, curb, and transition fittings.

2.2 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.

2.3 SOURCE QUALITY CONTROL

- A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Install units with clearances for service and maintenance.

- C. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.2 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. Connect wiring and ground equipment according to Division 26.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 3. Verify that cleaning and adjusting are complete.
 - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 - 5. Adjust belt tension.
 - 6. Adjust damper linkages for proper damper operation.
 - 7. Verify lubrication for bearings and other moving parts.
 - 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 - 9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
 - 10. Shut unit down and reconnect automatic temperature-control operators.
 - 11. Remove and replace malfunctioning units and retest as specified above.
- C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.

- C. Comply with requirements in 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

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01, 08 and 23 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Section 23 33 00 – Air Duct Accessories

1.2 SUMMARY

- A. Section Includes:
 - 1. Rectangular and square ceiling diffusers.
 - 2. Perforated diffusers.
 - 3. Louver face diffusers.
 - 4. Adjustable bar registers and grilles.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated, include the following:
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - 2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.
- B. Samples for Initial Selection: For diffusers, registers, and grilles with factory-applied color finishes.
- C. Samples for Verification: For diffusers, registers, and grilles, in manufacturer's standard sizes to verify color selected.
- D. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
 - 1. Ceiling suspension assembly members.
 - 2. Method of attaching hangers to building structure.

3. Size and location of initial access modules for acoustical tile.
 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
 5. Duct access panels.
- E. Source quality-control reports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Products: Subject to compliance with requirements, provide one of the products specified.
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 GRILLES AND REGISTERS

- A. Adjustable Sidewall Supply:
1. Product: Price 520
 2. Manufacturers:
 - a. Price Industries.
 - b. Titus.
 - c. Anemostat; a Mestek Company.
 3. Steel supply grilles shall be of the sizes and mounting types shown on the plans and outlet schedule. The deflection blades shall be available parallel to the long or short dimension of the grille. Construction shall be of steel with a 1-1/4 inch wide border on all sides. Screw holes shall be countersunk for a neat appearance. Corner shall be welded with full penetration resistance welds.
 4. Deflection blades shall be contoured to a specifically designed and tested cross-section to meet published test performance data. Blades shall be spaced on 3/4-inch centers. Blades shall have steel friction pivots on both ends to allow individual blade adjustment without loosening or rattling. Plastic blade pivots are not acceptable.
 5. The manufacturer shall provide published performance data for the grille. The grille shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.
- B. Sidewall Return and Exhaust Register:

1. Product: Price 530
2. Manufacturers:
 - a. Price Industries.
 - b. Titus.
 - c. Anemostat; a Mestek Company.
3. The fixed deflection blades shall be available parallel to the long or short dimension of the grille. Construction shall be of steel with a 1-1/4-inch wide border on all sides. Screw holes shall be countersunk for a neat appearance. Corners shall be welded with full penetration resistance welds.
4. Deflection blades shall be contoured to a specifically designed and tested cross-section to meet published test performance data. Blades shall be firmly held in place by mullions from behind the grille and fixed to the grille by welding in place. Blade deflection angle shall be available at 35°.
5. The grille finish shall be #26 white. The finish shall be an anodic acrylic paint, baked at 315° F for 30 minutes. The pencil hardness must be HB to H. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering, or deterioration of film. The paint must pass a 250-hour ASTM D870 Water Immersion Test. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50-inch pound force applied.
6. The manufacturer shall provide published performance data for the grille. The grille shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 23 41 00

PARTICULATE AIR FILTRATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Pleated panel filters.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include dimensions; operating characteristics; required clearances and access; rated flow capacity, including initial and final pressure drop at rated airflow; efficiency and test method; fire classification; furnished specialties; and accessories for each model indicated.
- B. LEED Submittals:
 - 1. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
 - 2. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
- C. Shop Drawings: For air filters. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Show filter rack assembly, dimensions, materials, and methods of assembly of components.
- D. Operation and Maintenance Data: For each type of filter and rack to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE Compliance:
 - 1. Comply with applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality"; Section 5 - "Systems and Equipment"; and Section 7 - "Construction and Startup."

2. Comply with ASHRAE 52.1 for arrestance and ASHRAE 52.2 for MERV for methods of testing and rating air-filter units.
- C. Comply with NFPA 90A and NFPA 90B.

1.5 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Provide one complete set(s) of filters for each filter bank. If system includes pre-filters, provide only prefilters.

PART 2 - PRODUCTS

2.1 PLEATED PANEL FILTERS

- A. Description: Factory-fabricated, self-supported, extended-surface, pleated, panel-type, disposable air filters with holding frames.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Airguard.
 - b. Camfil Farr.
 - c. Filtration Group.
 - d. Flanders-Precisionaire.
 - e. Koch Filter Corporation.
- B. Filter Unit Class: UL 900, Class 2.
- C. Media: Interlaced glass or synthetic fibers coated with nonflammable adhesive.
 1. Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Separators shall be bonded to the media to maintain pleat configuration.
 3. Welded wire grid shall be on downstream side to maintain pleat.
 4. Media shall be bonded to frame to prevent air bypass.
 5. Support members on upstream and downstream sides to maintain pleat spacing.
- D. Filter-Media Frame: Cardboard frame with diagonal supports sealed or bonded to the media.
- E. Capacities and Characteristics:

1. Face Dimensions: 20" x 20" or 16" x 25" or as required by unit manufacturer.
2. Thickness or Depth: 2 inches. (Unless noted otherwise in equipment schedules.)
3. ECI Rating: 5 stars
4. Surface Area: 17.3 s.f. (based on a 24" x 24" filter).
5. System Airflow: 2,000 CFM (based on a 24" x 24" filter)
6. Maximum or Rated Face Velocity: 500 fpm.
7. Efficiency: 90 percent on particles 20 micrometers and larger at 500 fpm.
8. Arrestance: 85 percent when tested according to ASHRAE 52.1.
9. Initial Resistance: 0.31 inch wg at 500 fpm.
10. Recommended Final Resistance: 1 inch wg.
11. MERV Rating: 13 when tested according to ASHRAE 52.2.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.
- B. Install filters in position to prevent passage of unfiltered air.
- C. Install filter gage for each filter bank.
- D. 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.
- E. Coordinate filter installations with duct and air conditioning unit installations.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 1. Test for leakage of unfiltered air while system is operating.
- B. Air filter will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.3 CLEANING

- A. After completing system installation and testing, adjusting, and balancing of air-handling and air-distribution systems, clean filter housings and install new filter media.

END OF SECTION

SECTION 23 74 13

PACKAGED OUTDOOR ROOFTOP AC UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes packaged, outdoor, rooftop units with the following components and accessories:
 - 1. Direct-expansion cooling.
 - 2. Heat pump.
 - 3. Economizer outdoor- and return-air damper section.
 - 4. Integral, space temperature controls.

1.3 DEFINITIONS

- A. DDC: Direct-digital controls.
- B. ECM: Electrically commutated motor.
- C. Outdoor-Air Refrigerant Coil: Refrigerant coil in the outdoor-air stream to reject heat during cooling operations and to absorb heat during heating operations. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.
- D. Outdoor-Air Refrigerant-Coil Fan: The outdoor-air refrigerant-coil fan in RTUs. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.
- E. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, outdoor, central-station air-handling units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.
- F. Supply-Air Fan: The fan providing supply air to conditioned space. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.
- G. Supply-Air Refrigerant Coil: Refrigerant coil in the supply-air stream to absorb heat (provide cooling) during cooling operations and to reject heat (provide heating) during heating operations. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

1.4 SUBMITTALS

- A. **Product Data:** Include manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.
- B. **Shop Drawings:** Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. **Wiring Diagrams:** Power, signal, and control wiring.
- C. **Manufacturer Wind Loading Qualification Certification:** Submit certification that specified equipment will withstand wind forces identified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
 - 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. **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.
 - 4. Campus Standard Building Management Control System (BMCS)
- E. **Field quality-control test reports.**
- F. **Operation and Maintenance Data:** For RTUs to include in emergency, operation, and maintenance manuals.
- G. **Warranty:** Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

- A. **ARI Compliance:**
 - 1. Comply with ARI 210/240 and ARI 340/360 for testing and rating energy efficiencies for RTUs.
 - 2. Comply with ARI 270 for testing and rating sound performance for RTUs.
- B. **ASHRAE Compliance:**
 - 1. Comply with ASHRAE 15 for refrigeration system safety.
 - 2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
 - 3. Comply with applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment", Section 5.5 "Mold Resistance of Airstream Surfaces", Section 5.6 "Location of Outside Air Intakes", Section 5.11 "Design of Condensate Pans", and Section 7 - "Construction and Startup."

- C. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- D. NFPA Compliance: Comply with NFPA 90A and NFPA 90B for flame spread and smoke generation.
- E. UL Compliance: Comply with UL 1995.
- F. 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.
- G. Unit shall be Energy Star certified. (3 tons and larger)
- H. Roof curb shall be designed to conform to NRCA Standards.
- I. Unit casing shall be capable of withstanding Federal test method Standard No. 141 (Method 6061) 500-hour salt spray test. (3 tons and larger)
- J. Units shall be designed and manufactured in a facility registered by ISO.
- K. Units shall be run tested on the factory assembly line in both cooling and heating modes.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of RTUs that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Compressors: Minimum 5 years from date of Substantial Completion.
 - 2. Warranty Period for Solid-State Ignition Modules: Manufacturer's standard, but not less than three years from date of Substantial Completion.
 - 3. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.

1.7 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. Fan Belts: One set for each belt-driven fan.
 - 2. Filters: One set of filters for each unit.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Unit(s) shall be stored and handled per manufacturer's recommendations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Carrier.
 - 2. Trane.
 - 3. York.
- B. Basis of Design is Trane. If contractor submits on listed alternates, he shall assume monetary and logistical responsibility for any and all necessary structural, electrical, plumbing, architectural and HVAC modifications. Contractor shall also compensate the Architect of Record (AOR) and Mechanical Engineer of Record (MEOR) for efforts related to updating energy compliance calculations.

2.2 PACKAGED ROOFTOP HEAT PUMP UNIT

- A. SYSTEM DESCRIPTION
 - 1. Factory-assembled, single-piece Outdoor rooftop, or slab-mounted, electrically controlled heating and cooling unit. Include all factory wiring, piping, controls, refrigerant charge (R-410a), and fully hermetic scroll compressor. Unit shall discharge supply air vertically as shown on contract drawings.
- B. UNIT CABINET:
 - 1. Unit cabinet shall be constructed of galvanized steel, bonderized and coated with a baked enamel finish on all externally exposed surfaces, and have primer-coated interior panels.
 - 2. Evaporator-fan cabinet interior shall be insulated with a minimum .5-in. thick, 1 lb. density, and flexible fiberglass insulation. Insulation shall conform to AHRI 210/240 or 340/360 minimum exterior sweat criteria. Gas heat compartment shall use aluminum foil face fiberglass insulation.
 - 3. Cabinet panels shall be easily removable for servicing, and shall have molded composite handles.
 - 4. Holes shall be provided in the base rails for rigging shackles to facilitate overhead rigging, and forklift slots shall be provided to facilitate maneuvering.
 - 5. Unit shall have a factory-installed, sloped condensate drain pan made of a non-corrosive material, providing a minimum 3/4-in. connection with both vertical and horizontal drains and shall comply with ASHRAE 62.
 - 6. Unit shall have factory-installed filter access panel to provide filter access with tool-less removal.
- C. FANS:
 - 1. Indoor blower shall be of the belt-driven, double inlet, forward-curved centrifugal type. Belt drive shall include an adjustable-pitch motor pulley.
 - 2. Indoor blower shall be made from steel with a corrosion-resistant finish and shall be dynamically balanced.
 - 3. Bearings shall be of the sealed, permanently lubricated, ball-bearing type.
 - 4. Condenser fan shall be of the direct-driven propeller type and shall discharge air vertically upward.
 - 5. Condenser fan shall have aluminum blades riveted to corrosion-resistant steel spiders and shall be dynamically balanced.

6. Condenser-fan motor shall be energy-efficient type.
 7. Induced draft blower shall be of the direct-driven, single inlet, forward curved type made from steel with a corrosion-resistant finish.
- D. COMPRESSORS:
1. Fully hermetic scroll type, internally protected, with crankcase heater.
 2. Two compressors for two stage capacity control.
 3. Factory rubber-shock mounted and internally spring mounted for vibration isolation.
- E. COILS:
1. Provide standard evaporator and condenser coils shall have aluminum plate fins mechanically bonded to enhanced copper tubes with all joints brazed, with factory flexible epoxy polymer coating (E-COAT) on indoor and outdoor coils. Coating process shall ensure complete coil encapsulation of tubes, fins and headers. Corrosion durability shall be confirmed through testing to be no less than 1000 hours salt spray per ASTM B117-90.
- F. REFRIGERANT COMPONENTS:
1. Thermostatic Expansion Valve shall be standard.
 2. Service gage connections on suction and liquid lines. Include a gauge line access port in the top of the RTU to facilitate correct and accurate condenser pressure readings with the access panels in place.
 3. Filter drier.
- G. FILTER SECTION:
1. Standard filter section shall consist of factory-installed 2-inch low-velocity, throwaway filters of the same size.
 2. Filter face velocity shall not exceed 300 fpm at nominal airflow.
 3. Filter section shall use only one size filter.
 4. Filters shall be accessible through an access panel with "no-tool required" removal capability.
 5. Factory-installed filters are for start-up only, and will be replaced with pleated filters of the type and rating as shown on the equipment schedule. Filters are to be furnished and installed by the contractor.
- H. CONTROLS:
1. Shall be complete with self-contained low-voltage control circuit protected by a fuse on the 24V transformer side.
 2. Low ambient controls down to 35 F. ambient shall be standard, and shall not require the installation of a field-installed heat pressure control package.
 3. Unit shall include an Integrated Staging Control (ISC) that is intended for use with a standard thermostat or direct digital control. LED lights shall indicate if the unit is running properly or not. The configuration of red lights will indicate the type of error that the board has identified.
 4. Provide standard electro-mechanical unit controls without EMS interface. EMS communications card, and thermostat for OTHER EMS, to be furnished and installed by the controls contractor.
- I. SAFETIES (COOLING):
1. Compressor over-temperature, over-current, high pressure differential.
 2. Loss-of-charge/low-pressure switch.

3. Automatic reset, motor thermal overload protector.
 4. High-pressure switch.
- J. OPERATING CHARACTERISTICS:
1. Unit shall be capable of starting and running at 125 F ambient outdoor temperature.
 2. Compressor with standard controls shall be capable of operation down to 40 F ambient outdoor temperature.
 3. All unit power wiring shall enter unit cabinet at a single factory pre-drilled location.
- K. MOTORS:
1. Compressor motors shall be cooled by refrigerant passing through motor windings and shall have line break thermal and current overload protection.
 2. Evaporator Fan Motor shall be a high efficiency multi-speed ECM motor.
 3. Indoor blower (evaporator-fan) motor shall have permanently lubricated bearings and inherent automatic-reset thermal overload protection.
 4. Condenser-fan motor shall have permanently lubricated bearings and inherent automatic-reset thermal overload protection.
 5. Induced draft motor shall have permanently lubricated, sealed bearings and inherent automatic reset thermal overload protection.
- L. CONDENSATE PAN:
1. Internally sloped pan made of non-corrosive material with 3/4" drain connections on side or bottom of pan. ASHRAE 62 compliant.
- M. SPECIAL FEATURES:
1. VIBRATION ISOLATION ROOF CURB:
 - a. Refer to contract drawings for applicability. 16 gauge formed galvanized steel capable of supporting entire unit weight. Supply and return air openings shall be as shown on the contract drawings. Curb shall be structurally-calculated and meet the seismic requirements of the current California Building Code (CBC). Include calculations signed and stamped by a licensed California structural engineer. Provide unit hold-downs.
 - b. Curb shall be provided with Factory acoustical option.
 - c. Curb shall be 21 inches tall.
 - d. Allow for installing and securing ductwork to curb prior to mounting unit on the curb.
 2. CONTROLS:
 - a. Provide units with factory BACnet controller.
 3. INTEGRATED ECONOMIZER:
 - a. Provide fully modulating microprocessor-controlled gear-driven economizer with barometric relief. Economizer shall be of low-leak design, conform to ASHRAE 90.1, and have a maximum leakage rate equal to 4.0 cfm/sq. ft. @ 1.0 in. w.g. Factory assembled, designed to relieve 100% of the return air in order to maintain proper building pressure. Include 100% shut-down on loss of power and barometric relief damper. All fan motors shall be UL certified. Capable of sensing outdoor-air enthalpy content (temperature and humidity) and controlling economizer cut-in point to have minimum heat content air passing over the evaporator coil for most efficient system operation.
 - b. Provide with 100% barometric relief as specified on contract drawings.
 - c. Economizer actuator shall be Belimo, model TFB24-SR.

- d. Provide 100% modulating power exhaust assembly as specified on the contract drawings. Provide space pressure tubing as required. Tubing shall terminate in the ceiling of the space which the unit serves. Provide chrome escutcheon at tubing ceiling termination.
- e. Economizer/power exhaust module shall mount directly on the air conditioning unit. Remote power exhaust will not be accepted.
- 4. CONDENSER COIL GUARD GRILLE:
 - a. Louvered grille designed to protect the condenser coil from damage by vandalism or flying debris while not inhibiting unit clearances or serviceability.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of RTUs.
- B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.
- C. Examine roofs for suitable conditions where RTUs will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Roof Curb: Install on roof structure, level and secure, according to NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Division 07 Section "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 curbs. Coordinate wall penetrations and flashing with wall construction. Secure RTUs to structural support with anchor bolts.

3.3 CONNECTIONS

- A. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.
- B. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
 - 1. Install ducts to termination at top of roof curb.
 - 2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
 - 3. Connect supply ducts to RTUs with flexible duct connectors specified in Division 23 Section "Air Duct Accessories."
 - 4. Install return-air duct continuously through roof structure.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Perform tests and inspections and prepare test reports.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Report results in writing.
- C. Tests and Inspections:
 - 1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
 - 2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Remove and replace malfunctioning units and retest as specified above.

3.5 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Complete installation and startup checks according to manufacturer's written instructions and do the following:
 - 1. Inspect for visible damage to unit casing.
 - 2. Inspect for visible damage to compressor, coils, and fans.
 - 3. Inspect internal insulation.
 - 4. Verify that labels are clearly visible.
 - 5. Verify that clearances have been provided for servicing.
 - 6. Verify that controls are connected and operable.
 - 7. Verify that filters are installed.
 - 8. Clean condenser coil and inspect for construction debris.
 - 9. Remove packing from vibration isolators.
 - 10. Inspect operation of barometric relief dampers.
 - 11. Verify lubrication on fan and motor bearings.
 - 12. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
 - 13. Adjust fan belts to proper alignment and tension.
 - 14. 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.
 - 15. Inspect and record performance of interlocks and protective devices; verify sequences.
 - 16. Operate unit for an initial period as recommended or required by manufacturer.
 - 17. Calibrate thermostats.
 - 18. Adjust and inspect high-temperature limits.

19. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
20. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F above return-air temperature:
 - a. Coil leaving-air, dry- and wet-bulb temperatures.
 - b. Coil entering-air, dry- and wet-bulb temperatures.
 - c. Outdoor-air, dry-bulb temperature.
 - d. Outdoor-air-coil, discharge-air, dry-bulb temperature.
21. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
22. 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.
23. 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.
24. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

3.6 CLEANING AND ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site during other-than-normal occupancy hours for this purpose.
- B. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain RTUs. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

SECTION 26 00 00

GENERAL ELECTRICAL SPECIFICATIONS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. This specification shall apply to all phases of Work hereinafter specified, shown on Drawings, or as required to provide a complete installation of electrical systems for this Project. Work required under this specification is not limited to just the Electrical Drawings - refer to Architectural, Structural, Landscape, and Mechanical/Plumbing Drawings, as well as all other drawings applicable to this project, which designate the scope of work to be accomplished. The intent of the Drawings and Specifications is to provide a complete and operable electrical system that includes all documents that are a part of the Contract.
 - 1. Work Included: Furnish labor, material, services and skilled supervision necessary for the construction, erection, installation, connections, testing, and adjustment of all circuits and electrical equipment specified herein, or shown or noted on Drawings, and its delivery to the Owner complete in all respects ready for use.
 - 2. The electrical Work includes installation or connection of certain materials and equipment furnished by others. Verify installation details, installation and rough-in locations from the actual equipment or from the equipment shop drawings.
- B. Electrical Drawings: Electrical Drawings are diagrammatic, and are intended to convey the scope of work, indicating intended general arrangement of equipment, conduit and outlets. Follow Drawings in laying out Work and verify spaces for installation of materials and equipment based on actual dimensions of equipment furnished.

1.2 QUALITY ASSURANCE

- A. Design, manufacture, testing and method of installation of all apparatus and materials furnished under requirements of these specifications shall conform to latest publications or standard rules of the following:
 - 1. Institute of Electrical and Electronic Engineers - IEEE
 - 2. National Electrical Manufacturers' Association - NEMA
 - 3. Underwriters' Laboratories, Inc. - UL
 - 4. National Fire Protection Association - NFPA
 - 5. Federal Specifications - Fed. Spec.
 - 6. American Society for Testing and Materials - ASTM

7. American National Standards Institute - ANSI
 8. National Electrical Code - NEC
 9. National Electrical Safety Code - NESC
 10. Insulated Cable Engineers Association - ICEA
 11. American Institute of Steel Construction - AISC
 12. State and Municipal Codes In Force In The Specific Project Area
 13. Occupational Safety and Health Administration (OSHA)
 14. Electronics Industries Association/Telecommunications Industry Association (EIA/TIA)
 15. California Electrical Code (where adopted)
 16. Local Authority Having Jurisdiction (AHJ) Published Electrical Standards and Codes
- B. Perform Work in accordance with the National Electrical Code, applicable building ordinances, and other applicable codes, hereinafter referred to as the "Code." The Contractor shall comply with the Code including local amendments and interpretations without added cost to the Owner. Where Contract Documents exceed minimum requirements, the Contract Documents take precedence. Where code conflicts occur, the most stringent shall apply unless variance is approved.
1. Comply with all requirements for permits, licenses, fees and codes. The Contractor, at Contractor's expense, shall obtain all permits, licenses, fees, special service costs, inspections and arrangements required for Work under this contract, unless otherwise specified.
 2. Comply with requirements of the applicable utility companies serving this Project. Make all arrangements with utility companies for proper coordination of Work.

1.3 GENERAL REQUIREMENTS

- A. Guarantee: Furnish a written guarantee for a period of (1) one-year from date of acceptance.
- B. Wherever a discrepancy in quantity or size of conduit, wire, equipment, devices, circuit breakers, etc., (all materials), arises on the Drawing and/or Specifications, the Contractor shall be responsible for providing and installing all material and services required by the strictest condition noted on Drawings and/or in Specifications to ensure complete and operable systems as required by the Owner and Engineer.

C. All Core Cutting, Drilling, and Patching:

1. For the installation of work under this Section, the aforementioned shall be performed under this Section of the Specifications and the Concrete section of the Specifications.
2. No holes will be allowed in any structural members without the written approval of the Project's Structural Engineer.
3. For penetrations of concrete slabs or concrete footings, the work shall be as directed in the Concrete Section of Specifications.
4. The Contractor shall be responsible for patching and repairing surfaces where he is required to penetrate for work under this contract.
5. Penetrations shall be sealed to meet the rated integrity of the surface required to be patched and repaired. The patched surface shall be painted or finished to match the existing surface.

D. Verifying Drawings and Job Conditions:

1. The Contractor shall examine all Drawings and Specifications in a manner to be fully cognizant of all work required under this Section.
2. The Contractor shall visit the site and verify existing conditions. Where existing conditions differ from Drawings, adjustment(s) shall be made and allowances included for all necessary equipment to complete all parts of the Drawings and Specifications.

1.4 WORK IN COOPERATION WITH OTHER TRADES

- A. Examine the Drawings and Specifications and determine the work to be performed by the electrical, mechanical and other trades. Provide the type and amount of electrical materials and equipment necessary to place this work in proper operation, completely wired, tested and ready for use. This shall include all conduit, wire, disconnects, relays, and other devices for the required operation sequence of all electrical, mechanical and other systems or equipment.
- B. Provide a conduit-only system for low voltage wiring required for control of mechanical and plumbing equipment described in this or other parts of the Contract Documents. Install all control housings, conduits, and backboxes required for installing conductors to the controls.
- C. Install separate conduits between each heating, ventilating and air conditioning sensing device and its control panel and/or control motor. Before installing any conduit for heating, ventilating and air conditioning control wiring, verify the exact requirements from the control diagrams provided with the equipment manufacturer's shop drawings.

1.5 TESTING AND ADJUSTMENT

- A. Upon completion of all electrical work, the Contractor shall test all circuits, switches, light fixtures, lighting control and dimming systems including distributed systems, UPSs, generators, SPDs, lighting inverters, transfer switches, motors, circuit breakers, motor starters and their auxiliary circuits and any other electrical items to ensure perfect operation of all electrical equipment.
- B. Equipment and parts in need of correction and discovered during such testing, shall be immediately repaired or replaced with all new equipment and that part of the system shall then be retested. All such replacement or repair shall be done at no additional cost to the Owner.
- C. All circuit(s) shall be tested for continuity and circuit integrity. Adjustments shall be made for circuits not complying with testing criteria.
- D. All test reports, including copies of any required Energy Code Acceptance Forms (e.g. CA Title 24 Acceptance for Code Compliance Forms) should be submitted to the Engineer at completion of project.

1.6 IDENTIFICATION

- A. Nameplates shall be provided for unit substations, switchgear, switchboards, distribution boards, distribution panels, panel boards, motor control centers, transformers, transfer switches, contactors, starters, disconnect switches, enclosed circuit breakers/switches, inverters, UPSs, PDUs, RDCs, SPDs, lighting control panels, dimming panels, door releasing system panels, fire alarm/central monitoring terminal cabinets/power supplies/control panels, and all low voltage system terminal and control cabinets.
 - 1. Nameplate inscriptions shall be identical to the equipment designations indicated in plans and specifications. Nameplates shall be engraved with the device designation/identification on the top line, source identification for the device on the 2nd line per NEC, or CEC where adopted, Art 408.4 and load designation for the device on the bottom line. Where load designation consists of a branch circuit, omit bottom line. Where device designation is not indicated on plans/specifications, Contractor shall submit a written clarification request to the Engineer.

Example: Transformer 1TA

Source Disconnecting Location: Switchboard MSA located in Rm 110

Load: Panels 1LA and 1 LB

2. All circuit breakers/fuses in switchgear, switchboards, distribution boards, distribution panels, UPS output circuit breakers, PDU sub-feed circuit breakers and motor control centers shall have individual nameplates located immediately adjacent to the respective device. Nameplate inscription shall identify the downstream equipment or device served by the circuit breaker or fuse.
- B. Identification nameplates, UON, shall be laminated/extruded modified acrylic that is 3/32" thick, UV-stabilized, matte finish, suitable for use in 180 deg. F ambient, with beveled edges and engraved white letters 3/8" high, minimum, on 1-1/2" high black background (utility/normal and optional standby power systems) for single line of text. Where two lines of text are required, provide minimum 2" high nameplate. Where three lines of text are required, provide minimum 2.5" high nameplate. Provide white letters on red background for all NEC, or CEC where adopted, Article 517 essential power systems, Article 700 Emergency Systems, Article 701 Legally required standby systems and Article 708 COPS.
- C. Identification nameplates for new switchgear, switchboards, distribution boards, distribution panels, panel boards and motor control centers shall be attached with switchgear manufacturer-provided screws via switchgear manufacturer factory pre-drilled holes. A factory option to rivet identification nameplates to the equipment is only acceptable if screw-fastened nameplates are not an available option from the switchgear manufacturer. Field drilling or other mechanical attachment methods that change/void the NEMA or NTRL rating of the enclosure are strictly forbidden.
- D. Identification nameplates for transformers, transfer switches, disconnect switches, enclosed circuit breakers/switches, inverters, UPSs, PDUs, RDCs, SPDs, lighting control panels, dimming panels, door releasing system panels, terminal cabinets and all circuit breakers/fuses in switchgear, switchboards, distribution boards, distribution panels, UPS output circuit breakers, PDUs, PDU sub-feed circuit breakers, and motor control centers shall be attached to the equipment by self-adhesive backing integral to the nameplates. When equipment is located outdoors, provide nameplates without self-adhesive backing and attach to equipment using weather-rated, UV-resistant epoxy. In all cases, clean surfaces before applying identification nameplates parallel to equipment lines.
- E. Warning Placards, as required by General Single Line Diagram Notes for multiple power sources, or instruction placards, as required for all kirk-key interlock schemes, all UPS bypass procedures or as required elsewhere in the plans/specifications shall be engraved 1/2" high white lettering on a red background using the same material specified for identification nameplates with a self-adhesive backing. Warning/instruction placards shall be attached to the face of the equipment directly related to the placards. Provide a formal placard submittal for review by the Engineer prior to ordering any warning/instruction placards. In all cases, clean surfaces before applying warning/instruction placards parallel to equipment lines.

- F. Receptacles that are part of a UL-listed under floor computer room whip assembly, ceiling and/or cable/ladder tray-mounted receptacles used in lab, manufacturing, commercial kitchen environments or that are serving telecom/data/AV racks and cabinets shall have identification nameplates located on the wiring device plate cover. Nameplates shall be self-adhesive, 3/32" thick Micarta with beveled edges, engraved 1/4" high white lettering on black background with serving power source, circuit identification and NEMA/IEC receptacle type. Use of two (2) separate nameplates per device plate cover is acceptable. Affix nameplates to be visible when plugs are occupying receptacles.
- G. See wiring device section of this specification for wiring device plate cover labeling requirements.
- H. See drawings for panel board schedule directory installation requirements.
- I. See conduit installation section of this specification for conduit labeling requirements.

1.7 FINAL INSPECTION AND ACCEPTANCE

- A. After all requirements of the Specifications and/or the Drawings have been fully completed; representatives of the Owner will inspect the work. Contractor shall provide competent personnel to demonstrate the operation of any item or system to the full satisfaction of each representative.
- B. Final acceptance of the work will be made by the Owner after receipt of approval and recommendation of acceptance from each representative.

1.8 RECORD DRAWINGS

- A. Drawings of Record: The Contractor shall provide and keep up-to-date, a complete record set of drawings. These shall be corrected daily and show every change from the original Drawings. This set of prints shall be kept on the job site and shall be used only as a record set. This shall not be construed as authorization for the Contractor to make changes in the layout without definite instruction in each case. Upon completion of the work, a set of reproducible Contract Drawings shall be obtained from the General Contractor and all changes as noted on the record set of prints shall be incorporated thereon with black ink in a neat, legible, understandable and professional manner. Refer to the Supplementary General Conditions for complete requirements.

1.9 APPROVALS, EQUALS, SUBSTITUTIONS, ALTERNATIVES, NO KNOW EQUAL

- A. Approvals: Where the words (or similar terms) "approved", "approval", "acceptable", and "acceptance" are used, it shall be understood that acceptance by the Owner, Architect and Engineer are required.

- B. Equal: Where the words (or similar terms) “equal”, “approved equal”, “equal to”, “or equal by”, “or equal” and “equivalent” are used, it shall be understood that these words are followed by the expression “in the opinion of the Owner, Architect, and Engineer.” For the purposes of specifying products, the above words shall indicate the same size, made of the same construction materials, manufactured with equivalent life expectancy, having the same aesthetic appearance/style (includes craftsmanship, physical attributes, color and finish), and the same performance.
- C. Substitution: For the purposes of specifying products, “substitution” shall refer to the submittal of a product not explicitly approved by the construction documents/specifications.
1. Substitutions of specified equipment shall be submitted and received by the Engineer ten (10) days prior to the bid date for review and written approval. Regulatory Agency approval for all substitutions will be the sole responsibility of the Contractor. To receive consideration, requests for substitutions must be accompanied by documentary proof of its equality with the specified material. Documentary proof shall be in letterform and identify the specified values/materials alongside proposed equal values/materials. In addition, catalog brochures and samples, if requested, must be included in the submittal. **ONLY PRE-BID APPROVED PRODUCTS, ISSUED VIA A FORMAL BID ADDENDUM TO ALL BIDDERS, WILL BE ALLOWED ON THE PROJECT. REGARDLESS OF THE APPROVAL ON ANY SUBSTITUTION, ALL BIDS SHALL BE BASED ON THE PRODUCTS EXACTLY AS SPECIFIED. PRICING FOR EACH APPROVED SUBSTITUTION SHALL BE INCLUDED IN THE BID SUBMITTAL AS A SEPARATE LINE ITEM.**
 2. In the event that written authorization is given for a substitution, after award of contract, the Contractor shall submit to the Engineer quotations from suppliers/distributors of both the specified and proposed equal material for price comparison, as well as a verification of delivery dates that conform to the project schedule.
 3. In the event of cost reduction, the Owner will be credited with 100 percent of the reduction, arranged by Change Order.
 4. The Contractor warrants that substitutions proposed for specified items will fully perform the functions required.
- D. Alternates/Alternatives: For the purposes of specifying products, “alternatives/alternates” may be established to enable the Owner/Architect/Engineer to compare costs where alternative materials or methods might be used. An alternate price shall be submitted in addition to the base bid for consideration. If the alternate is deemed acceptable, written authorization will be issued.
- E. No Known Equal: For the purposes of specifying products, “No Known Equal” shall mean that the Owner/Architect/Engineer is not aware of an equivalent product. The Contractor will need to submit a “Substitution” item, per the requirements listed above, if a different product is proposed to be utilized.

1.10 SHOP DRAWINGS/SUBMITTALS

- A. Shop Drawings/Submittals, unless required otherwise by general project specifications or instructions to bidders, shall be submitted in electronic format (PDF) to include a Letter of Transmittal (PDF), which shall give a list of the drawings submitted with dates and/or system(s) components contained within the submittal. Drawings and material cut sheets shall be complete in every respect and edited/marked to indicate specific items being provided. Printed/Hard copies are not acceptable.
- B. The Shop Drawings/Submittals shall be marked with the name of the project, numbered consecutively, and bear the approval of the Contractor as evidence that the Contractor has checked the Drawings. Any Drawings submitted without this approval will be returned to the Contractor for resubmission.
- C. If the shop drawings show variations from the requirements of the Contract because of standard shop practice or other reasons, the Contractor shall make specific mention of such variations in the Contractor's letter of transmittal. If the substitution is accepted, the Contractor shall be responsible for proper adjustment that may be caused by the substitution. Samples shall be submitted when requested.
- D. Only products listed as "Equal" within the contract documents, along with formally approved "Substitutions" will be reviewed. Products not conforming to these items will not be reviewed and will be returned to the Contractor for re-submittal.
- E. Review comments used in response to shop drawings/submittals are:
 - 1. "No Exception Taken" - Product approved as submitted.
 - 2. "Furnish as Corrected" - Re-submittal not required, although the Contractor shall provide the submitted product with corrections as noted.
 - 3. "Revise and Resubmit" - Re-submittal required with corrections as noted.
 - 4. "Rejected" - Re-submittal required based upon the originally specified product.
- F. Shop drawings shall be submitted on the following but not limited to:
 - 1. Lighting Fixtures, Lamps, and Ballasts.
 - 2. Switchgear, Switchboards, Distribution Boards, Motor Control Centers, Panel boards, and Bus Ducts; complete with overcurrent device information.
 - 3. Transformers.
 - 4. Fire Alarm System/Central Monitoring System.
 - 5. Wiring Devices.
 - 6. Lighting Control System/Dimming System Products.

7. Pullboxes and Underground Vaults.
8. Terminal Cabinets
9. Lighting Inverters, UPSs, RDCs, PDUs, Generators, Transfer Switches, SPD Systems.
10. Cable Tray, Flexible Cable Tray and Cable Runway.
11. Power Poles and Floor Boxes.
12. Arc Flash, Short-Circuit and Coordination studies.
13. All other products called out on drawings that call for shop drawing submittal.

1.11 MAINTENANCE, SERVICING, INSTRUCTION MANUALS AND WIRING DIAGRAMS

- A. Prior to final acceptance of the job, the Electrical Contractor shall furnish to the Owner at least four (4) copies of operating, maintenance, and servicing instructions, as well as four (4) complete wiring diagrams for the following, but not limited too, items or equipment:
 1. Lighting Control System/Dimming Systems.
 2. Fire Alarm System.
 3. Transformers.
 4. Switchgear, Switchboards, Distribution Boards, Motor Control Centers, Panel boards, and Bus Ducts; complete with overcurrent device information
 5. Lighting Inverters, UPS's, PDUs, Generators, Transfer Switches, SPD Systems
- B. All wiring diagrams shall specifically cover the system supplied. Typical drawings will not be accepted. Four (4) copies shall be presented to the Owner.

1.12 INTERRUPTION OF SERVICE/SERVICE SHUTDOWN

- A. Any interruption of electrical services, electrical circuits, electrical feeders, signal systems, communication systems, fire alarm systems, etc. required to perform work, shall meet the specific prior-approval requirements of the Owner. Such work shall be scheduled with the Owner to be performed at the Owner's convenience.
- B. Interruptions/outages of any of the Owner's systems and services mentioned above shall be scheduled to occur during other than the Owner's normal business hours. Any overtime costs shall be borne by the Contractor.
- C. See drawings for any additional requirements regarding outages, interruption and any temporary services required.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Materials and Equipment: All electrical materials and equipment, including custom-made equipment, shall be new and shall be listed by Underwriter's Laboratories (UL) and bear their label or be listed and certified by a Nationally Recognized Testing Lab (NRTL) that is also recognized by the local Authority-Having-Jurisdiction (AHJ)
- B. Switchgear/Switchboards/Distribution Boards/Motor Control Centers:
 - 1. See general single line notes on single line drawing for more information.
- C. Panel boards – Branch Circuit:
 - 1. See drawings for panel board schedules and specifications.
- D. Transformers:
 - 1. See drawings for transformer schedules and specifications.
- E. Lighting Fixtures:
 - 1. See drawings for lighting fixture and lamp schedules and additional specifications. Furnish, install and connect a lighting fixture at each outlet where a lighting fixture type symbol (designated on plans) is shown as being installed. Each fixture shall be complete with all required accessories including sockets, glassware, boxes, spacers, mounting devices, fire rating enclosure and lamps.
 - 2. Ballasts: See lighting fixture schedule notes. All noisy ballasts shall be replaced at no cost to the Owner.
 - 3. Lamps: See lamp/fixture schedule and lamp/lighting fixture schedule notes.
- F. Wiring Devices:
 - 1. Provide wiring devices indicated per plan. Devices shall be specification grade. Acceptable manufacturers are Leviton, Pass and Seymour and Hubbell. Provide all similar devices of same manufacturer, unless indicated otherwise. All device colors shall be from the full range of manufacturer standard color options as selected by the Architect. This selection will be made during the shop drawing review process
 - a. Wiring Devices (Decora)
 - 1) Convenience Receptacle #16252- ???
 - 2) Dedicated Receptacle #16352-???
 - 3) Convenience I.G. Receptacle #16262-IG- ???
 - 4) Dedicated I.G. Receptacle #16362-IG-???

- 5) Convenience G.F.C.I. Receptacle #GFT1-???
- 6) Dedicated G.F.C.I. Receptacle #GFNT2-???
- 7) Convenience Hospital Grade Receptacle #16252-HG?-???
- 8) Dedicated Hospital Grade Receptacle #16352-HG?-???
- 9) Convenience G.F.C.I. Hospital Grade #GFNT1-HG?
- 10) Dedicated G.F.C.I. Hospital Grade #GFNT2-HG?
- 11) Tamper Resistant Convenience Receptacle #TDR15-???
- 12) Tamper Resistant Dedicated Receptacle #TDR20-???
- 13) Tamper Resistant GFCI Receptacle #GFTR2-???
- 14) Tamper Resistant. Convenience. G.F.C.I. Hospital
Grade Receptacle #GFTR1-HG?
- 16) Tamper Resistant. Dedicated. G.F.C.I. Hospital
Grade Receptacle #GFTR2-HG?
- 18) Weather/Tamper Resistant GFCI Receptacle #GFWT2-???
- 19) Convenience Simplex Receptacle #16251-???
- 20) Dedicated Simplex Receptacle #16351-???
- 21) Recessed Clock Receptacle #5361-CH-???(Non-Decora)
- 22) Single Pole Switch #5621-2-???
- 23) Double Pole Switch #5622-2-???
- 24) Three Way Switch #5623-2-???
- 25) Four Way Switch #5624-2-???
- 26) Pilot Light Switch "On" #5628-2-???
- 27) Pilot Light Switch "Off" #5631-2-???
- 28) Projection Screen Switch #5657-2-???
- 29) Low Voltage Momentary Switch #5657-2-???
- 30) Keyed Switch #1221-2L-???(Non-Decora)

31) Door Jam Switch #1865-???

- b. Use of dedicated receptacles is required where plans depict a branch circuit supplying only a single simplex or duplex receptacle. Use of controlled receptacles is required where depicted on plans - see controlled receptacle specifications for additional information.
2. I.G. (isolated ground) receptacle bodies shall be of a basic color specified above with an orange triangle to symbolize isolated ground.
3. H.G. (hospital grade) receptacle bodies shall be of a basic color specified above with a green circle to symbolize hospital grade.
4. When shown circuited with an I.G. conductor, receptacles shall be of an I.G. type. As an example, a NEMA L6-30R denoted on the plans and shown circuited with an I.G. conductor shall be an I.G. version of that receptacle.
5. Wiring devices located in wood finished areas shall generally be black unless otherwise indicated by the Architect.
6. Wiring devices located in mirrors shall generally be white with stainless steel cover plates unless otherwise indicated by the Architect.
7. In addition to other device requirements listed elsewhere in this specification, 125V (Volt), 15A (Amp) and 20A Tamper-Resistant wiring devices shall be provided as follows:
 - a. In dwelling units per NEC, or CEC where adopted, Article 210.52.
 - b. In pediatric care areas per NEC, or CEC where adopted, Article 517.18(C).
 - c. In child care or day care facilities.
 - d. In wet and/or exterior locations.
8. Wiring device cover plates located on recessed boxes shall be commercial grade nylon. Plate color shall match wiring device color UON on plans. Cover plates utilized on surface mounted boxes shall be metal. Plastic cover plates are unacceptable.
9. Except as otherwise noted, all wiring device plates on the project shall be labeled with panel and circuit number(s) utilizing a Brother P-Touch labeling system with 1/2" tape (yellow on black) or equal by Herman-Tellerman or Panduit. Locate label on the concealed side of the wiring device plate. Handwritten labels are unacceptable.
10. The Contractor shall provide duplex receptacle outlets in the appropriate configurations necessary to comply with applicable energy code requirements for controlled receptacles and as shown on plans. All wiring devices indicated to be controlled receptacles shall be NEMA-approved, electrical code-compliant with

factory markings on the face of the receptacle(s) with the word "Controlled" or utilize further markings and symbols to indicate which receptacles on each outlet is/are controlled. Stickers, field-applied markings or other non-permanent markings are not acceptable. Where a GFCI receptacle outlet is required to be controlled, provide an adjacent controlled duplex receptacle outlet connected on the load side of the GFCI outlet. Generally, one receptacle in a duplex receptacle outlet is required to be controlled. It may be the lower receptacle or upper receptacle based on manufacturer offering. However, the controlled receptacle location within a controlled receptacle outlet shall remain consistent throughout the project. Where an existing duplex receptacle outlet is required to be controlled, provide a new wiring device with the appropriate control configuration necessary to comply with plans. All controlled receptacles shall be connected to a branch circuit controlled by an occupancy sensor-based or relay panel lighting control system. Acceptable manufacturers are Leviton, Pass and Seymour and Hubbell.

11. The following wiring device plates shall have custom engraving:

- a. Key operated switches, switches with pilot lights, and switches for the control of motors, heaters and ventilators. Engraving shall be black and occur on the exposed side of the plate indicating the motor, heater, or ventilator controlled.
- b. Receptacles on optional standby generator and/or UPS power shall have custom engraved plates with the words "Generator" or "UPS" in black letters. In addition, where located in telecommunications closets, IDFs, server rooms, data centers, labs (wet, dry or electronic) indicate panel board and circuit number.
- c. All stainless steel and nylon device plates shall be engraved using a rotary engraving process except for black lettering on stainless steel device plates which may be accomplished via laser etching process. All lettering shall be 3/16" high. Provide a dimensioned submittal drawing detailing a typical device faceplate with engraving.

G. Weatherproof Outlet Covers/Assemblies: All Receptacles identified as weatherproof on the drawings shall be weather-resistant, tamper-resistant, GFCI type and equipped as follows:

1. Type WP-A: Recessed wall box with a hinged, lockable, cast aluminum, self-closing, gasket-equipped door that is wet location-listed rain tight while "in use". Unit shall comply with NEC, or CEC where adopted, Article 406.9(A) and (B). UON on drawings, provide a minimum of 2 separate compartments suitable for installation of power receptacles, AV or communications outlets. Additionally, unless otherwise noted on drawings, provide the following:
 - a. A 20A weather-resistant, tamper-resistant, GFCI duplex receptacle in the first compartment. Provide branch circuiting per plans.
 - b. A blank metal plate suitable for field installation of power, AV or

communications devices in the second compartment.

- c. Where indicated on plans as requiring data, AV, or other low voltage service outlet, provide minimum 3/4" C.O. with pull string routed from the second compartment to nearest low voltage pull box. Where shown mounted in a building wall, any blank/unused compartment shall be equipped min. 3/4" C.O. with pull string routed to the nearest accessible ceiling space.
 - d. See wiring device section of this specification for additional wiring device plate cover labeling requirements.
 - e. 1 key minimum per device (minimum of 2 per project) to the Owner's project manager upon completion of project.
 - f. Custom color powder coat finish as selected by Architect - Include all costs in base bid for same.
 - g. In locations with sufficient wall depth, provide 6" wide x 6" tall x 5-1/2" deep recessed wall box (C.W. Cole #TL310-WCS-K1-CUSTOM COLOR).
 - h. In locations utilizing shallow stud walls construction or other walls of insufficient depth, provide 10-3/4" wide x 7-3/8" tall x 3-7/8" deep recessed wall box (C.W. Cole #TL310-WCS-SH-K1 -CUSTOM COLOR).
 - i. See drawings for additional details.
2. Type/Subscript WP-B: Wet location-listed raintight while "in use" cast copper-free aluminum lockable cover with baked aluminum lacquer finish and one gang, weather-resistant, tamper-resistant GFCI receptacle. Hubbell WP26E series. Polycarbonate covers are unacceptable. Unit shall comply with NEC, or CEC where adopted, Article 406.9(A) and (B). Contractor shall powder coat cover assembly to a custom color where receptacle locations are deemed by the Architect to be in aesthetically sensitive or public spaces. Custom color as selected by Architect.
3. Type WP-C: (C.W. Cole #TL310-WCS-PED-ADA-K1-CUSTOM COLOR or #TL310-WCS-PED-K1-CUSTOM COLOR) pedestal device box with a hinged, lockable, cast aluminum, self-closing, gasket-equipped door that is wet location-listed raintight while "in use". Unit shall comply with NEC, or CEC where adopted, Article 406.8(A) and (B). UON on drawings, provide a minimum of 2 separate compartments suitable for installation power receptacles, AV or communications outlets. Additionally, unless otherwise noted on drawings, provide the following:
- a. A 20A weather-resistant, tamper-resistant, GFCI duplex receptacle in the first compartment. Provide branch circuiting per plans.
 - b. A blank metal plate suitable for field installation of power, AV or communications devices in the second compartment.

- c. Where indicated on plans as requiring data, AV, or other low voltage service outlet, provide minimum 3/4" C.O. with pull string routed from the second compartment to nearest low voltage pull box.
 - d. See wiring device section of this specification for additional wiring device plate cover labeling requirements.
 - e. 1 key minimum per device (minimum of 2 per project) to the Owner's project manager upon completion of project.
 - f. Include all costs in base bid for ADA version (22.5" tall) of pedestal box. Prior to ordering material, contractor shall coordinate with Architect and/or AHJ to determine which pedestal box locations do not require ADA compliance and may be changed to the standard (11.5" tall) version of the pedestal box.
 - g. Custom color powder coat finish as selected by Architect. Include all costs in base bid for same.
 - h. See drawings for additional details.
4. Type/Subscript WP-D: Damp location-listed (not-Raintite-in-use) cast copper-free, pad lockable, die-cast aluminum cover with baked aluminum lacquer finish and one gang GFCI receptacle. Hubbell/Rayco 502?/503? Series. Polycarbonate covers are unacceptable. Unit shall comply with NEC, or CEC where adopted, article 406.9(A) and (B). Custom color powder coat finish as selected by Architect. Include all costs in base bid for same.
- H. Motor Controllers/Starters: See drawings for motorized equipment schedules and specifications.
- I. Circuit Breakers:
- 1. Service entrance circuit breakers smaller than 400A (Amp) frame shall be thermal-magnetic trip with inverse time current characteristics unless otherwise indicated below. Service entrance main circuit breakers and main circuit breakers. 400A frame and larger shall be 100% rated, solid-state type as outlined in this specification. All other service entrance circuit breakers, 400A frame and larger, shall be 100% rated, solid-state type as outlined in this specification.
 - 2. All non-service entrance circuit breakers 225A and larger shall be thermal magnetic type and have continuously adjustable instantaneous pick-ups of approximately 5 to 10 times trip rating. Breakers shall have either tamper-resistant rating dials or easily changed trip rating plugs with trip ratings as indicated on the Drawings. Rating plugs shall be interlocked so they are not interchangeable between frames. Additionally, all non-service entrance circuit breakers, 600A frame and larger, located in 480V, 3-phase, 3-wire or 277/480V, 3-phase, 4-wire switchgear, distribution boards, panel boards or busway plugs shall be solid state, 100% rated. Breaker shall have built-in test points for testing

long delay, short delay and instantaneous, and ground fault (where shown) functions of the breaker by means of a 120V operated test kit. Contractor shall utilize a test kit capable of testing all breakers 400A and above - at the Engineer's request.

3. All non-service entrance circuit breakers less than 225A shall be molded plastic case, air circuit breakers conforming to UL 489. Provide breakers with thermal magnetic trip units, and a common trip bar for two- or three-pole breakers, connected internally to each pole so tripping of one pole will automatically trip all poles of each breaker. Provide breakers of trip-free and trip-indicating bolt-on type, with quick-make, quick-break contacts. Provide single two- or three-pole breaker interchangeability. Provide padlocking device for circuit breakers as shown on the Drawings.
4. Where a Current Limiting Circuit Breaker (CLCB) is indicated on drawings or as required elsewhere in this specification, provide a UL listed current limiting thermal magnetic circuit breaker(s) UON. An independently operating limiter section within a molded case is not allowed. Coordinate CLCB ratings as required to protect electrical system components on the load side of the CLCB to include, but not limited to, protecting automatic transfer switches, panel boards and lighting control panels.
5. Where a solid-state circuit breaker is indicated on drawings or as required elsewhere in this specification, provide a solid-state circuit breaker with minimum five function complete with built-in current transformers. The five functions shall be independently adjustable and consist of Overload/Long Time Amp Rating, Long Time Delay, Short Time Delay, Short Circuit/Instantaneous Pickup, but may also include Shunt Trip and/or Ground Fault if so indicated on the Drawings. Rating plugs shall be interlocked so they are not interchangeable between frames. Breaker shall have built-in test points for testing long delay and instantaneous, and ground fault (where shown) functions of the breaker by means of a 120V operated test kit. Contractor shall utilize a test kit capable of testing all breakers 400A and above, at the Engineer's request.
6. Ground Fault Interrupting Breakers: Provide with molded plastic case, air circuit breakers, similar to above with ground fault circuit interrupt capability, conforming to UL Class A, Group 1.
7. Arc Fault Interrupting Breakers: Provide with molded plastic case, air circuit breakers, similar to above with arc fault circuit interrupt capability, conforming to UL 1699. Provide on all dwelling-unit circuits supplying bedrooms, sleeping quarters etc. as required to comply with NEC, or CEC where adopted, Article 210.12.
8. Tandem or half-sized circuit breakers are not permitted.
9. Series-Rated Breakers: UL listed series-rated combinations of breakers can be used to obtain panelboard-interrupting ratings shown on Drawings. If series-rated breakers are used, switchboards, distribution boards, and panel boards shall be appropriately labeled to indicate the use of series-rated breakers. Shop

drawing submittal shall include chart of UL listed devices, which coordinate to provide series rating.

10. Circuit breakers shall be standard interrupting construction. Panelboard shall accept standard circuit breakers up to 100A.
11. Circuit breaker handle accessories shall provide provisions for locking handle in the on or off position.
12. Shunt-trip equipped circuit breakers shall be provided on all elevator feeders.
13. Temperature compensating circuit breaker(s) shall be provided when located in outdoor enclosure(s) or when located in an enclosure subject to high ambient heat due to due nearby industrial processes, etc.
14. Provide 75 degree Celsius-rated conductor lugs/lug kits as required on all circuit breakers to accept conductor quantities and sizes shown on drawings.
15. All circuit breaker terminations shall be suitable for use with 75 degree Celsius ampacity conductors. Listed, dual-rated pin terminals, straight or offset, are acceptable for use to in accommodating oversized or parallel conductor installations.
16. Circuit breakers serving Fire Alarm or Central Monitoring panels and power supplies shall be red in color and lockable in the "ON" position.

J. Disconnect Switches:

1. Non-fusible or fusible, heavy-duty, externally-operated horsepower-rated, 600V A.C: Provide NEMA 3R, lockable enclosures for all switches located on rooftops, in wet or damp areas and in any area exposed to the elements.
2. Fusible switches shall be Class "R" when 600A or less or Class "L" when greater than 600A.
3. Amperage, Horsepower, Voltage and number of poles per drawings: All shall be clearly marked on the switch nameplate.
4. Provide the Owner's project manager with one (1) spare set of fuses and two (2) sets of fuse clips/fuses for every set of fuses on the project.

K. Fuses:

1. Provide fuses at all locations shown on the Drawings and as required for supplemental protection:
 - a. Fuses shall be manufactured by Bussman, Shawmut, or equal.
 - b. All fuses shall be the product of a single manufacturer.
2. Main and Feeder Protection:

- a. Protective devices rated greater than 600A: Provide Bussman Hi-Cap fuses, Class L, current limiting, having an interrupting rating of 200,000A RMS.
 - b. Protective devices rated 600A or less: Provide Bussman Class R fuses, Class RK series current limiting fuses, having an interrupting rating of 200,000A RMS.
- 3. Motor Protection:
 - a. Where rating of protective device is greater than 600A, provide Bussman Hi-Cap fuses, Class L, current limiting, having an interrupting rating of 200,000A RMS.
 - b. Where rating of protective device is 600A or less, provide Bussman Class RK series current limiting fuses, having an interrupting rating of 200,000A RMS.
 - c. Where fuses feeding motors are indicated, but not sized, it shall be the responsibility of the Contractor to coordinate the fuse size with the motor to provide proper motor running protection.
 - d. When rejection type fuses are specified (Class RK series) the fuse holder of all switches (specified in other Sections) shall be suitable for the fuses provided.
- L. Cable Tray, Flexible Cable Tray and/or Cable Runway:
 - 1. See drawings for Cable Tray, Flexible Cable Tray and/or Cable Runway specifications.
- M. Uninterruptible Power Systems (UPS):
 - 1. See drawings for UPS schedules and specifications.
- N. Power Distribution Units (PDU):
 - 1. See drawings for PDU schedules and specifications.
- O. Generator Systems:
 - 1. See drawings for Generator schedules and specifications.
- P. Transfer Switches:
 - 1. See drawings for Transfer Switch schedules and specifications.
- Q. Lighting Control/Dimming Systems:
 - 1. See drawings for Lighting Control and/or Dimming Systems schedules and specifications.

2. Wall box dimmers shall be rocker-type as manufactured by Lutron (no known equal except as noted below). Dimmers and dimmer faceplates shall match the color of adjacent switches and faceplates. Dimmers and dimmer faceplates in wood finished areas shall generally be black unless otherwise indicated by the Architect. The Contractor shall obtain written approval of the Architect regarding final dimmer and dimmer faceplate color selection prior to ordering material. Multiple dimmers/switches shall be ganged together with a common cover plate. Provide dimmers as follows:
 - a. Incandescent: Lutron DIVA DV-10P or DV-103P (3-way) (1000 Watt max.).
 - b. Electronic Low Voltage: Lutron DIVA DVELV-300P or DVELV-303P- (3-way) (300 Watt).
 - c. Magnetic Low Voltage: Lutron DIVA DVLV-10P or DVLV103p (3-way) (800 Watt max.).
 - d. Fluorescent (3-Wire): Lutron DIVA DVF-103P (single/3way, 8A @ 120V) or DVF-103P-277 (single/3way, 6A @ 277V).
 - e. Fluorescent (0-10V): Lutron DIVA DVTV with PP-???H Power Pack.
 - f. Fluorescent (Lutron Tu-Wire): Lutron DIVA DVFTU-5A3P with Lutron H.P. module where required.
 - g. LED (0 - 10V): Lutron DIVA DVTV with PP-???H Power Pack.
 - h. Screw Base CFL/LED: Lutron DIVA DVCL-153P.
 - i. Fan Control: Lutron DIVA DVFSQ-F (1.5A @ 120V max, 3 speed, single pole, 3-way).
3. Contractor shall verify if dimmer(s) requires derating when ganged. Contractor shall provide, and provide connections to, additional Lutron Power Modules, Lutron Power Packs, and / or Lutron Interface Modules where required to accommodate loads higher than dimmers standard or derated load-carrying capacity. Note - contractor may to provide a Lutron recommended dimmer type (typically a #DVF-103P unit) to control the necessary power modules or interface devices.

R. Fire Alarm System/Central Monitoring System:

1. See drawings for Fire Alarm System or Central Monitoring System specifications.

S. Surge Protective Device (SPD):

1. See drawings for SPD specifications.

T. Conduit:

1. Galvanized Rigid Conduit (GRC) shall be full weight threaded type steel. Steel

conduit shall be protected by overall zinc coating to inside and outside surfaces, applied by the hot dip, metalizing, or sherardizing process.

2. Intermediate Metal Conduit (IMC), shall be hot-dipped galvanized in accordance with UL 1242, and meet Federal Specification WWC-581 (latest revision).
3. Electrical Metallic Tubing (EMT) shall be zinc-coated steel with baked enamel or plastic finish on inside surfaces. EMT shall be dipped in a chromic acid bath to chemically form a corrosion-resistant protective coating of zinc chromate over galvanized surface.
4. Flexible metal conduit shall be constructed of aluminum or hot-dipped galvanized steel strips wound spirally with interlocking edges to provide greatest flexibility with maximum strength. Interior surfaces shall be smooth and offer minimum drag to pulling in conductors. Use only as directed in writing by the Engineer with the exception of 400 Hz feeders and 400 Hz branch circuits which shall be run in flexible aluminum conduit.
5. Liquid-tight conduit (Seal-Tite) shall be galvanized steel flexible conduit as above except with moisture and oil-proof jacket, pre-cut lengths and factory-installed fittings. For outdoor installations and motor connections only unless otherwise noted on drawings.
6. Factory assembled, or off-site assembled wiring systems (such as Metal Clad (MC) Cable, Type AC Cable, Type NM Cable, Type BX Cable, etc.) shall not be used unless otherwise indicated in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section generally located on the symbols list drawing.
7. When approved for use in the Allowed Specification Deviations Section, generally located on the symbols list drawing, MC cables shall be allowed for lighting branch circuits (homeruns shall be EMT), receptacle branch circuits (homeruns shall be EMT) and poke-thru fed systems furniture homeruns. MC shall not be used where exposed, except for a maximum 6' length for final connections to light fixtures, or terminate in electrical panelboards or distribution boards. Equipment ground conductor shall be green. Isolated ground conductor shall be green with yellow stripe. Provide 600V rated aluminum or lightweight steel interlocking armor Metal Clad (MC) cable with copper conductors, THHN (90 degree C) insulation, and integral equipment grounding conductor and isolated grounding conductor as required. Type AC cable listed for use in patient care areas for non-essential electrical system branch circuits per NEC or CEC where adopted, Article 517.13 shall be required in such areas in lieu of MC cable. Type AC and MC cable shall not be used for essential electrical system branch circuits. MC cable shall be manufactured to Underwriter Laboratory Standard 1569. See PART 3 - EXECUTION section of this specification for additional installation requirements.
8. Nonmetallic Flexible Tubing (ENT) shall not be used unless otherwise indicated in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section generally located on the symbols list drawing. Use of ENT, if

allowed, is strictly limited to use in CMU walls and parking structures decks or as directed in writing by the Engineer. See PART 3 - EXECUTION section in this specification for additional installation requirements.

9. Non-Metallic Conduit:

- a. Polyvinyl chloride (PVC) rigid conduit, Schedule 40, Type II for underground installation only with solvent welded joints, conforming to Underwriters Laboratories, Inc. (UL) requirements, listed for exposed and direct burial application.
- b. Conduit and fittings shall be produced by the same manufacturer.

10. Fire-rated MC Cable:

- a. 2-hour fire-rated, polymer insulated 600V MC cable listed and conforming to Underwriters Laboratories, Inc. (UL) 2196 and UL 1569 requirements for installation as an Electrical Circuit Protective System for use in complying with NEC, or CEC where adopted, Articles 695 and 700. Where adopted, cable sheath shall be suitable for use as a NEC or CEC equipment grounding conductor, and shall be listed for use in wet locations to 90 degrees C (Raychem or equal).
- b. Cable connectors shall be brass MC connectors.

U. Fittings:

1. Condulet type fittings shall be smooth inside and out, taper threaded with integral insulating bushing and of the shapes, sizes and types required to facilitate installation or removal of wires and cables from the conduit and tubing system. These fittings shall be of metal, smooth inside and out, thoroughly galvanized, and sherardized cadmium plated.
2. Metallic condulet covers shall have the same finish as the fitting and shall be provided for the opening of each fitting where conductors do not pass through the cover.
3. Connector, coupling, locknut, bushings and caps used with rigid conduit shall be steel, threaded and thoroughly galvanized. Bushings shall be insulated.
4. UON all EMT fittings, connectors and couplings installed in concealed locations, areas not considered to be wet or damp locations by the AHJ, or areas not subject to physical damage, shall be steel, zinc or cadmium plated, threadless, compression, steel locking ring type with insulated throat. Where suitable for use, steel set screw fittings are allowed for trades sizes of 2" and smaller. Insulated throat is not required for fittings, connectors and couplings 1" and smaller.
5. All interior and exterior EMT fittings, connectors and couplings, 2" and smaller, installed in exposed or concealed locations that are considered by the AHJ to be

wet or damp locations, shall be Raintite-listed, steel, zinc or cadmium plated, threadless, compression, steel locking ring type with insulated throat. If Raintite-listed, EMT fittings, connectors and couplings are unavailable for a given trade size or if conduit is installed in an area subject to damage – provide rigid metallic or intermediate metallic conduits, fittings, connectors and couplings as required.

6. Flexible steel conduit connectors shall be a malleable iron clamp or squeeze type or steel twist-in type with insulated throat. The finish shall be zinc or cadmium plating.
7. Conduit unions shall be "Erickson" couplings, or approved equal. The use of running threads will not be permitted.

V. 600 Volt Conductors - Wire and Cable:

1. All conductors shall be copper. Provide stranded conductor for #10 AWG and larger or when making flexible connections to vibrating machinery. Use compression "fork" type connectors or transition to solid conductors when connecting to switches, receptacles, etc.
2. Type THHN/THWN-2 thermoplastic, 600 volt, UL approved, dry and wet locations rated at 90 degrees Celsius, for conductors of all sizes from #12 AWG up to and including 1000 kcmil. RHH/RHW insulation is allowed only to provide an Electrical Circuit Protective System to comply with NEC, or CEC where adopted, Articles 695 and 700.
3. Wire and cable shall be new, manufactured not more than six (6) months prior to installation, shall have size, type of insulation, voltage rating and manufacturer's name permanently marked on outer covering at regular intervals.
4. Wire and cable shall be factory color-coded by integral pigmentation with a separate color for each phase and neutral. Each system shall be color-coded and it shall be maintained throughout.
5. Systems Conductor Color Coding:
 - a. Power 208/120V, 3PH, 4W:
 - 1) Phase A = Black
 - 2) Phase B = Red
 - 3) Phase C = Blue
 - 4) Neutral = White or White with Phase Color Tracer
 - 5) Switch legs = Purple (Switch legs shall also be identified separately by numerical tags).
 - 6) Travelers = Purple with Black stripe or Pink.

- b. Power 480/277V, 3PH, 4W:
 - 1) Phase A = Orange
 - 2) Phase C = Yellow
 - 3) Neutral = Grey or Grey with Phase Color Tracer
 - 4) Switch legs = Purple (Switch legs shall also be identified separately by numerical tags).
 - 5) Travelers = Purple with black stripe or Pink.
- c. Ground Conductors: Green
- d. Isolated Ground Conductors: Green with continuous yellow stripe.
- e. Fire Alarm System: As recommended by the manufacturer.
- 6. All color-coding for #12 through #6 AWG conductor shall be as identified above. Conductors #4 AWG and larger shall be identified with utilizing phase tape at each termination.
- 7. No conductors carrying 120V or more shall be smaller than #12 AWG.
- 8. Aluminum conductors shall not be used.
- 9. Wire-pulling compounds used as lubricants in installing conductors in raceways shall only be "Polywater J". No oil, grease, graphite, or similar substances may be used. Pulling of #1/0 or larger conductors shall be done with an approved cable pull machine. Other methods; e.g. using vehicles and block and tackle to install conductors are not acceptable.

W. Medium Voltage Conductors (greater than 600V):

- 1. See drawings for Medium Voltage Cable Schedule and Specifications.

X. Junction and Pullboxes:

- 1. For interior dry locations, boxes shall be NEMA 1 galvanized one-piece drawn steel, knockout type, with removable, machine screw secured covers.
- 2. For outside, damp or surface locations, boxes shall be NEMA 3R heavy cast aluminum or cast iron with removable, gasketed, non-ferrous machine screw secured covers.
- 3. For in-grade applications, junction and pull boxes shall be pre-cast concrete or molded fiberglass manufactured by Christy, Brooks-Jensen, or Utility Vault Co. Fiberglass boxes shall:
 - a. Be used only in landscape planter areas that are not subject to damage from

lawnmowers, tractors and other machinery.

- b. Not be used in lawn or turf areas.
 - c. Not exceed 11" W x 17" L in size unless required to be larger to meet code requirements.
- 4. All boxes shall be sized for the number and sizes of conductors and conduits entering the box and equipped with plaster rings where required.
 - 5. All boxes located in traffic areas shall be traffic rated.

Y. Outlet Boxes:

- 1. For fixtures, boxes shall be galvanized, one-piece drawn steel, knockout type equipped with 3/8" fixture studs and plaster rings where required.
- 2. For convenience outlets, wall switches, or other devices, outlet boxes shall be galvanized one-piece drawn steel, knockout type 4" x 4" x 2-1/8" minimum size with plaster rings as required.
- 3. For locations where standard boxes are not suitable due to number and size of conduit to be terminated, special boxes shall be designed to fit space or meet other requirements, and submitted for approval.
- 4. For exposure to weather, damp locations, or surface mounting, outlet boxes shall be heavy cast aluminum or cast iron with threaded hubs; covers shall be watertight with gaskets and non-ferrous screws.
- 5. Outlet boxes used for support of ceiling fans shall be galvanized, one-piece drawn steel, knockout type equipped with bracing bars and plaster rings where required and listed for ceiling fan support use. Such boxes shall be labeled and capable of supporting ceiling fan weights up to 70 pounds.
- 6. See drawings for floor box installation notes and specifications.

- Z. Plywood Backboards: Where indicated for telephone or communications system terminals or other equipment assemblies, provide backboards of size indicated. Use 3/4" thick x 8' all (length per plans), Douglas Fir, void-free, kiln-dried, fire-rated plywood finished on one side and prime coat painted on all surfaces with finish coat of enamel paint, color by Architect. Leave one (1) fire-rating stamp/sheet exposed for inspection.

AA. Terminal Cabinets:

- 1. Terminal cabinets shall be fabricated of hot dipped galvanized code gauge sheet metal for flush or surface mounting, complete with barriered sections, a door for each vertically barriered section and sizes as indicated on plan. Doors shall be hinged and lockable. Locks shall be keyed to match the branch circuit panelboards. Terminal cabinet trims shall match the branch circuit panels.

2. Provide each terminal cabinet with a full size mounting backplate.
3. Terminal cabinets shall be installed complete with full-length skirts of the same construction and finish as the terminal cabinet.
4. Where mounted outdoors, terminal cabinets shall be NEMA 3R, weatherproof complete with gaskets and required sealant to prevent moisture from entering the terminal cabinet.
5. All terminal cabinets and terminal cabinet barriered sections shall be labeled by the cabinet or cabinet section use (i.e. CATV, Security, etc.). Labels shall be Micarta type as specified elsewhere in these specifications. Unless otherwise noted, all termination blocks and cables shall be labeled per ANSI/EIA 606 standard.

BB. Painting: Terminal cabinets, panels, junction boxes, pull boxes, etc., and conduit installed in public view shall be painted with colors selected by the Architect to match the subject surfaces. Refer to painting section of the specifications for additional requirements.

CC. Seismic Design, Certification and Anchoring of Electrical Equipment:

1. Contractor shall include all costs in the base bid for labor, materials, all special inspections and structural engineering design necessary to meet the Seismic Design Requirements for Non-structural Components (Chapter 13, ACE SEI 7-05 Minimum Design loads for Buildings and Other Structures) as required by IBC, or CBC where adopted, Section 1708 and as related to the installation all electrical equipment furnished under this contract. See Specific Project Site Seismic Criteria on architectural and/or structural plans which include Building Occupancy Category, Seismic Design Category, Design Spectral Response Acceleration (SDS), Height factor ratio (z/h) and Site Class. Non-structural Component Importance Factor (IP) for a particular component shall be determined based on the following criteria:
 - a. IP = 1.0: Non-life safety, Non-structural Components in an Occupancy Category IV Facility not required for continued operations of the facility or in any other Occupancy Category Facility where component failure will not impair continued operation of the facility.
 - b. IP=1.5: Designated Seismic Systems are those non-structural components in any Occupancy Category IV facility (except as noted above) or that are a part of any code-defined Critical, Life Safety, Emergency and Legally Required Standby Electrical System. Additionally, those non-structural components containing hazardous materials shall be classified as Designated Seismic Systems. While Designated Seismic Systems are generally identified on the plans, they may include items such as generators, automatic transfer switches, UPS units and all associated electrical distribution equipment and components necessary for the designated seismic system to form a complete and operable system. The Contractor shall ultimately be responsible for identifying Designated Seismic Systems.

For any electrical component either identified on the plans or determined by the contractor to be a Designated Seismic System, all line and load side electrical distribution systems supporting that Designated Seismic System (including, but not limited to, feeders, panel boards switchboards, transformers, all related component supports and attachments etc.) shall be considered a part of the designated seismic system for the purposes of code-compliance and seismic certification.

- c. z/h - Height factor ratio: See plans for respective equipment locations.
2. Provide a delegated-design submittal for each of the following seismic-restraint systems to be used as required:
- a. Restraint Channel Bracings consisting of 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, with other matching components, and with corrosion-resistant coating; rated in tension, compression, and torsion forces.
 - b. Restraint Cables consisting of ASTM A 603 galvanized-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service, with a minimum of two clamping bolts for cable engagement.
 - c. Seismic-Restraint Accessories consisting of hanger rod/hanger rod stiffener assemblies, multifunctional steel connectors for attaching hangers to rigid channel bracings and/or restraint cables, bushings for floor and wall-mounted equipment anchor bolts and resilient isolation washers and bushings.
 - d. Mechanical Anchor Bolts consisting of 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.
 - e. Adhesive Anchor Bolts consisting of drilled-in and capsule anchor system containing resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide specific LEED-compatible environmentally-friendly resins and adhesives on all LEED projects. 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.
3. Submittal shall include design calculations and details for selecting seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the contractor's structural engineer responsible for their preparation. Calculations shall include, but not be limited to, static and dynamic loading caused by equipment weight, operation, and seismic and, if applicable, wind forces required to select seismic and, if applicable, wind restraints and for designing vibration isolation bases. Provide seismic and wind-

restraint detailing to support system selection, arrangement of restraints, attachment locations, methods, and spacings with all components identified to include their strengths, directions and values of forces transmitted to the structure during seismic events and association with vibration isolation devices. Sizes of components shall be selected so strength will be adequate to carry present static and seismic loads to accommodate 25% spare future capacity within specified loading limits.

4. Any pre-approval and evaluation documentation shall have a California Office of Statewide Health Planning and Development (OSHPD) Special Seismic Certification Preapproval (OSP) demonstrating horizontal and vertical load testing and analysis showing maximum seismic-restraint ratings, by ICC-ES or another agency acceptable to authorities having jurisdiction. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) that support seismic-restraint designs must be signed and sealed by a qualified professional engineer.
 5. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified elsewhere in the project specifications.
 6. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where connection is terminated to equipment that is anchored to a different structural element from the one supporting them as they approach equipment. Flexible connection limitations of the NEC, or CEC where adopted, shall apply.
 7. Install seismic-restraint devices using methods approved by OSHPD or an agency acceptable to authorities having jurisdiction providing required submittals for component.
 8. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by OSHPD or an agency acceptable to authorities having jurisdiction.
 9. The contractor shall engage a qualified testing agency to perform tests and inspections as listed in other Project Specifications, but as a minimum shall include at least four of each type and size of installed anchors and fasteners selected by Architect. Schedule tests 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. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members as required. Test to 90 percent of rated proof load of device. Prepare and submit test and inspections reports.
- DD. Trenching and Backfilling: Contractor shall be responsible for trenching and backfilling. Refer to Trenching and Backfilling section of the specifications for

complete requirements.

PART 3 - EXECUTION

3.1 PREPARATION AND INSTALLATION

A. Installation of Conduit and Outlet Boxes:

1. All conduit installed in the dry walls or ceilings of a building shall be steel tube (EMT), aluminum tube (EMT), or Intermediate Metal Conduit (IMC). Flexible conduit shall not be used in lieu of EMT, IMC or rigid conduit except as noted herein.
2. Galvanized rigid conduit (GRC) or intermediate metal conduit (IMC) shall be used as follows:
 - a. When noted on the drawings.
 - b. When considered exposed to damage by the local AHJ.
 - c. When installed in wet or damp locations and of a trade size where listed-Raintite fittings, connectors, couplings etc. are unavailable.
 - d. When required by NEC or CEC Article 517.13.
 - e. When installed in concrete and masonry. The use of ENT in CMU walls and parking structures may be allowed only as directed in writing by the Engineer. Request for ENT substitution must be made prior to bid and in accordance with pre-bid substitution requests requirements of these specifications.
3. Intermediate metal conduit (IMC), is approved for use in all locations as approved for GRC or steel-tube EMT and in accordance with NEC, or CEC where adopted, Article 342.
4. Flexible steel conduit shall only be permitted to be used at light fixture outlets and connections to vibrating electrical equipment. Except when concealed in walls or other structural elements, all flexible steel conduit runs shall be less than 6'-0". All outdoor installation shall be made using liquid-tight flex with approved fittings. Include a separate insulated green ground conductor sized per NEC in each conduit. Other uses of flexible conduit shall be allowed only as approved in writing by the Engineer.
5. Flexible liquidtight conduit shall be installed in lieu of the flexible steel; where required by the NEC, or CEC where adopted, in damp and wet location, where exposed to weather, in refrigerated area (65°F or less), and/or between seismic joints. All rotating electrical equipment shall be supplied with flexible, liquid-tight conduit with appropriate slack and shall not exceed thirty-six (36) inches. Include a separate insulated green ground conductor sized per NEC in each conduit. Other uses of liquidtight flexible conduit shall be allowed as approved in writing

by the Engineer on a case by case basis.

6. Rigid metallic conduit installed underground or embedded in concrete shall be 1" trade size minimum and shall be wrapped with 20 mil. Polyvinylchloride plastic tape, PVC conduit installed underground or embedded in concrete shall be 3/4" minimum trade size.
7. Where required for providing an electrical circuit protective system to comply with NEC, or CEC where adopted, Articles 695 and 700 utilize UL Listed 2-hour fire-rated, MC cable or UL Listed 2-hour fire-rated RHH/RHW conductors in conduit.
8. Conduit shall be run so as not to interfere with other piping fixtures or equipment.
9. The ends of all conduit shall be cut square, carefully reamed out to full size and shall be shouldered in fitting.
10. No running threads will be permitted in locations exposed to the weather, in concrete or underground. Special union fittings shall be used in these locations.
11. Where conduit is underground, under slabs or grade, exposed to the weather, or in wet locations, make joints liquid tight and gas tight.
12. All metal conduit in masonry and concrete and where concealed under floor slabs shall have joints painted with thread compound prior to makeup.
13. PVC conduit shall not be run in walls except where approved by the Engineer prior to bid in limited instances that may include concrete or CMU walls used in site retaining, parking structures, or exterior equipment yard or enclosure walls, etc.
14. Where conductors enter a raceway or a raceway in a cabinet, pull box, junction box, or auxiliary gutter, the conductors shall be protected by a plastic bushing type fitting providing a smoothly rounded insulating surface.
15. Where conduit extends through roof to equipment on roof area, the Contractor shall provide flashing material compatible with the roofing system as required by the roofing specifications or as required by the Owner's roof warranty. This flashing shall be delivered to the roofing Contractor for installation. The actual location of all such roof penetrations and outlets shall be verified by the Architect/Owner. Contractor to verify type of flashing prior to bid and include all costs.
16. All conduit shall be supported at intervals not less than 6'-0" and within 12" from any outlet and at each side of bends and elbows. Conduit supports shall be galvanized, heavy stamped, two-hole conduit clamp properly secured.
17. Where conduit racks are used the rack shall consist of two piece conduit clamps attached to galvanized steel slotted channels, properly secured via threaded rods attached directly to the building structure.

18. Nail-in conduit supports, one-piece set screw type conduit clamps or perforated iron for supporting conduit shall not be used.
19. Seismic Conduit Support:
- a. All conduit shall be supported in such a manner that it is securely attached to the structure of the building. Attachment is to be capable of supporting the tributary weight of conduit and contents in any direction. Maximum spacing of support and braces are to be as follows:

<u>CONDUIT SIZE</u>	<u>MAXIMUM SPACING</u>
1/2" to 3"	6'-0"
3-1/2" to 4"	8'-0"

20. All conduit runs shall be installed parallel or perpendicular to walls, structural members, or intersection of vertical planes and ceilings. Field made bends and offset shall be avoided where possible. Crushed or deformed raceway shall not be installed.
21. Open knockouts in outlet boxes only where required for inserting conduit.
22. Locate wall outlet of the same type at same level in all rooms, except where otherwise noted.
23. Outlet boxes on metal studs shall be attached to metal hangers, tack welded or screwed to studs; on wood studs attachment shall be with wood screws, nails are not acceptable.
24. Recessed boxes shall not be mounted back-to-back in any wall; minimum offset shall be 24 inches.
25. Junction Boxes that do not contain any device(s) shall be located in storage rooms, electrical closets, or above accessible ceilings, not in hard lid ceilings or other forms of inaccessible ceilings. Place boxes which must be exposed to public view in a location approved by the Owner's Project Manager. Provide covers or plates to match adjacent surfaces as approved by the Owner's Project manager.
26. Surface mounted pull boxes, terminal cabinets, junction boxes, panel boards etc., shall be attached to walls using appropriate screws, fasteners, backing plates, stud blocking etc., as detailed on architectural and/or structural drawings. If architectural and/or structural drawings are not provided on the project, Contractor shall provide all necessary mounting hardware and backing support to comply with local building code requirements and any additional requirements imposed by the local Authority-Having-Jurisdiction.
27. Sleeves shall be installed where conduit passes through masonry or concrete walls and shall be 24 gauge galvanized steel no more that 1/2" greater in

diameter than the outside diameter of the conduit. When located in non-rated structures, caulk conduit sleeve with stone wool and waterproof below grade. When located in fire rated structures, provide UL listed fire stopping system. See fire stopping section of this specification for additional requirements.

28. All boxes shall be covered with outlet box protector, Appleton SB-CK, or similar device/method to keep dirt/debris from entering box, conduit or panels. If dirt/debris does get in, it shall be removed prior to pulling wires.
29. All boxes installed outdoors shall be suitable for outdoor installations, gasketed, screw cover, and painted as directed by the Architect with weatherproof paint to match building.
30. All conduit entries to outdoor mounted panels, cabinets, boxes, etc., shall be made using Myers "SCRU-TITE" hubs Series ST.
31. Provide nylon or a 1/8-inch O.D. polyethylene rope, rated at 250 pounds tensile strength, in all conduits more than 5 feet in length left empty for future use. Not less than 5 feet of rope shall be left at each end of the conduit. Tag all lines with a plastic tag at each end indicating the termination/stub location of the opposite end of the conduit.
32. All multiple conduit runs within suspended ceilings shall be suspended from building structure by means of unistrut hangers/racks, Conduit shall not be allowed to lay on ceiling or be supported from ceiling suspension wires or other suspension system. Support conduit to structure above suspended ceilings 8" minimum above ceiling to allow removal of ceiling tile. Maintain two-inch clearance above recessed light fixtures
33. All exposed conduits and support hardware shall be painted to match the finish of the wall or ceiling to which it is supported.
34. Where conduits or wireways cross seismic joints, provide approved flexible conduit connection or approved expansion/deflection fitting to allow for displacement of conduit in all three axes. Connection shall allow for movement in accordance with design of seismic joint. Non-flexible raceways crossing expansion joints or other areas of possible structural movement shall make provision for 3-way movement at such points by means of expansion/deflection fittings. Fittings shall be installed in the center of their axes of movement and shall not be deflected to make part of a conduit bend, or compressed or extended to compensate for incorrect conduit expansion/deflection fittings(s) complete with ground jumpers. Where necessary, provide approved expansion joints to allow for thermal expansion and contraction of conduit(s). Install expansion joints complete with ground jumpers.
35. Seal all conduits where termination is subject to moisture or where conduit penetrates exterior wall, floor or roof, in refrigerated areas, classified (hazardous areas) and as indicated on the drawings.
36. Except as otherwise indicated on the Drawings or elsewhere in these

specifications, bends in feeder and branch circuit conduit 2 inches or larger shall have a radius or curvature of the inner edge, equal to not less than ten (10) times the internal diameter of the conduit. Except where sweeping vertically into a building, and where sweep radius equals ten (10) times conduit diameter, underground communications and building interconnect conduits 3 inches or larger shall have a minimum 12'-6" radius or curvature of the inner edge. For the serving utilities, radius bends shall be made per their respective specifications.

37. Tag all empty conduits at each accessible end with a permanent tag identifying the purpose of the conduit, footage end-to-end, and the location of the other end. In wet, corrosive outdoor or underground locations, use brass, bronze, or copper 16 gauge tags secured to conduit ends with #16 or larger galvanized wire. Inscribe on the tags, with steel punch dies, clear and complete identifying information.
38. The following additional requirements shall apply to underground conduits:
 - a. Underground conduit shall be Schedule 40 PVC (polyvinyl chloride) unless otherwise indicated elsewhere in these specifications or as required per NEC, or CEC where adopted Article 517.13.
 - b. For all communications conduits 2" and larger and feeders 100A or greater, provide with a minimum 3" inch, (2,000 LB) concrete envelope, 2" inch minimum separation between conduits, installed at depth of not less than 24" below grade. (Provide concrete encasement and/or greater minimum conduit depth as required by the Utility Companies.) Conduit separation within a duct bank shall be maintained using plastic spacers located at 5'-0" intervals. Where power and communication conduits are run in a common trench, a 12" inch minimum separation shall be maintained between power and communication conduits or as required by Utility Companies. Where concrete encasement is not required by serving utilities for a utility-only duct bank, provide free draining sand bedding suitable to achieve 95% relative compaction based on ASTM D1557 using 6" lifts or directed by Utility Company Standards.
 - c. In all cases, where any conduit(s) pass under a building slab or footing, the electrical Contractor will provide a Bentonite clay or concrete barrier that conforms to the height and width of the trench excavation extending a minimum of 24" on either side of the foundation. In all cases, where conduit(s) pass through a sleeve in a footing or other foundation element, the electrical Contractor will provide a Bentonite clay or concrete barrier between the sleeve and the conduit(s) surrounding the conduit(s) for the entire depth of the sleeve. The barrier is required to prevent passage of moisture under or through the slab or footing via the trench or sleeve.
 - d. Where underground conduit passes under a building slab, concrete encasement may not be required, except as required above, contact the Engineer for written direction prior to omitting any encasement.
 - e. Underground conduits, which terminate inside building(s) below grade, such

as in a basement level, or which slope so that water might flow into interior building spaces, shall be sealed at the point of penetration with a modular conduit seal (Link-Seal or equal by Rox Systems). Conduit/conduit sealing system penetrations of waterproofing membranes/systems on existing structures shall be completely restored as required to maintain membrane/system manufacturer and installer warranty for the installation. All conduits shall be provided with a 4% slope away from buildings. All conduits shall be installed such that the water cannot accumulate in the conduit and such that water drains into the nearest manhole, pull box or vault – not into the facility. In instances where grade changes or elevation differences prevent sloping of conduit away from a building into the nearest manhole, pull box or vault or where accumulation of water in a manhole, pull box or vault may result in water traveling into the facility, conduits shall be sealed internally at each end of each conduit using conduit sealing bushing, sized as required for the conductors contained within the conduit (O-Z Gedney #CSBG 100psig withstand or equal). In all cases, install plugs or caps in spare (empty) conduits at both ends of each conduit (Jackmoon or equal) preventing both water and gas from entering the facility via the conduits.

- f. Include a separate insulated green ground conductor sized per NEC, or CEC where adopted, in each underground electrical feeder/branch circuit.
- g. All underground conduits with circuits rated at 40As or greater and all underground communications conduits shall be provided with a metallic marker tape located 12 inches below the finished grade.
- h. Where underground conduits sweep into/through slabs, utilize PVC 90 degree sweeps that transition, via female PVC adapter to GRC coupling mounted flush in slab. GRC couplings shall be 1/2 lap taped with 20-mil tape. If the distance of the conduit run between a sweep and the next connecting sweep, pullbox, vault or manhole exceeds 150 ft then the sweep shall be concrete encased. Exceptions:
 - 1) Communications conduits shown terminating at a finished floor shall have an additional 4" high GRC nipple equipped with a bushing, removable conduit plug, labeling tag and pull rope. Tie off pull rope to conduit plug.
 - 2) Utility conduit sweeps shall be installed per the requirements of the respective utility company.
- i. All PVC conduit shall be glued for a water and gas tight installation. The Contractor shall use appropriate solvent on all joints prior to gluing conduit and fittings together.
- j. All underground conduit work shall conform to the Federal, State and Local Safety Orders or Rules regarding excavations, trenches and related earthwork. For projects in California, refer to the California Code of Regulations, Title 8, Construction Code Sections 1540 and 1541 for additional requirements.

39. Installation of Metal Clad (MC) Cable (when use is permitted in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section, generally located on the symbols list drawing).
- a. Provide J-box above accessible ceiling prior to running MC cable within partitions or walls. J-box shall be permanently labeled with panel identification and circuit numbers contained within.
 - b. Overhead MC cable runs shall generally follow building lines to provide a neat and workmanlike installation.
 - c. Provide code-sized J-boxes to accommodate MC cable splicing in general. For systems furniture poke-through feeds utilizing MC cable, transition from MC cables to conduit and wire near the panelboard in the TI accessible ceiling space on the floor below the panel board via code-sized gutter(s). Utilize UL listed, insulated barrier strips with recessed screw heads (Ideal #89-6?? Series or equal) fastened within the gutter(s), terminate MC conductors on one side of the strips(s) and individual conductors in conduit from the panelboard(s) on the other side of the strip(s). Label each terminal strip(s) with panel designation. Label each phase conductor with circuit number using wire markers (Ideal or equal). Wire nuts are not an acceptable alternative to the terminal strips in these underfloor transition locations. Provide (1) spare 3/4" conduit from each gutter to its respective panelboard.
 - d. MC cable shall not run directly into panelboards, distribution boards or electrical rooms.
 - e. MC cabling shall be provided with its own code-approved ceiling support wires, cable hangers, individual spring steel support clips, steel trapeze hangers, threaded rods or dedicated #10 AWG drop wire. Cable supports shall be fastened to concrete slabs, beams, joists or other structural members of the building. In no case shall MC cable rest on ceilings, suspended ceilings or structures. Do not support MC cable using ceiling support wires. The use of nylon cable ties to support MC cable is not allowed.
 - f. Use lock or spring nut MC cable fittings.
 - g. Cable runs shall be continuous from wiring device to wiring device – no intermediate splicing J-boxes allowed.
 - h. When terminating or splicing at a junction, outlet, or switch box, cut the cable with an armored cable rotary cutter such that 6-inches of free conductors remain for connections or splices. Use screw-in or spring lock connector and ensure a proper bonding by firmly tightening the connector to both the box and cable. Insert an anti-short bushing at cable ends to protect conductors from abrasion and use insulated connectors.
 - i. MC cable bend radius shall not be less than seven (7) times the external diameter of the cable.

- j. MC cables passing through fire-rated walls or floors shall be firestopped as required with a UL listed system. See firestopping requirements outlined elsewhere in this specification for additional requirements.
 - k. Installation shall not exceed code requirements for total current carrying conductors in multiple MC Cable runs bundled together into a single MC cable hanger or strap, unless support device is specifically listed for such purpose. Neutrals shall be counted as current carrying conductors.
 - l. Maintain MC Cable clearance of at least 6 inches from hot water and any other high temperature pipes. Maintain at least 12-inches clearance between MC cable(s) and telecommunication conduits and cables. MC cable shall cross telecommunication cables and conduits at right angles.
 - m. MC cabling shall not be run through exposed ceilings, where open grid conditions exist, exposed on walls, or exposed to view. See Power Plan and Lighting Plan General Notes for additional requirements.
40. Installation of Electrical Nonmetallic Tubing (ENT) Cable (when use is permitted in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section generally located on the symbols list drawing).
- a. When approved for use in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section, generally located on the symbols list drawing, 1/2" and 3/4" trade size ENT shall be allowed for concealed lighting branch circuits, receptacle branch circuits and miscellaneous signal system circuits within concrete floors, walls and columns within parking structures.
 - b. ENT conduit shall meet the requirements of Underwriters Laboratories Standards 1479 and 1655, NEMA TC-13, and be UL-listed.
 - c. All ENT conduit, ENT fittings, ENT boxes and ENT accessories shall be UL listed and manufactured by the same manufacturer so as to form a complete ENT system. ENT systems shall only be used if they are listed for use in fire resistance rated concrete floors and ceilings with resistance ratings as indicated elsewhere in the project plans. ENT system shall comply with NEC, or CEC where adopted, Article 362.
 - d. All ENT fittings and ENT boxes shall be concrete-tight listed without the use of tape. Additionally, ENT fittings shall be constructed of high impact PVC and able to resist ENT conduit pull out forces of a minimum of 175 lbs. ENT fittings with fewer than 6 locking tabs for ENT connection shall utilize manufacturer approved glue as additional protection from fitting/conduit separation. ENT conduit to rigid conduit transition fittings shall be equipped with set screw fittings on the rigid conduit side of the fitting. ENT to metal box fittings shall be equipped with a threaded end and lock washer.
 - e. Where tubing enters a box, fitting, or other enclosure provide a bushing or adapter to protect conductors from abrasion unless the box, fitting, or

enclosure design provides equivalent protection.

- f. ENT junction boxes shall have brass screw inserts and shall be rated to support lighting fixtures weighing less than 50 lbs.
- g. Concrete tight metal boxes shall be used to support pendant hung fixtures or fixtures over 50 lbs.
- h. ENT shall be provided in continuous lengths between junction boxes without use of in-line splices or connectors and shall be clearly marked/labeled at least every 10 feet.
- i. All ENT conduit containing electrical branch circuits shall contain a code-sized equipment ground conductor.
- j. ENT shall transition to EMT, IMC, RMC, or rigid PVC, as appropriate or as called out elsewhere in this specification, for all exposed conduits within/on/under a parking structure.
- k. ENT shall transition to appropriately sized PVC expansion joint(s) at all structure expansion or seismic joints.
- l. ENT shall be securely fastened and supported every 2 – 3 ft. and within 1 ft. of every junction box and fitting to prevent movement and sag.
- m. ENT shall be routed straight without sags, or excessive bending. Where bends are required, comply with Table 362.24 of the NEC for minimum radius of bends. Number of bends shall not exceed quantity allowed by code where used for power and lighting branch circuit and/or feeder conductors. Where utilized for communications system conductors (phones, data cabling, etc.) number of bends shall not exceed the equivalent of (2) 90 degree bends with conduit length no more than 100 feet without installation of a TIA 569-compliant pull box.
- n. Separation of ENT from fittings, excessive sags, or deflections in ENT runs that prevent pulling of wire and other ENT system product or system installation failures/errors shall be corrected by saw cutting and patching as necessary at no additional cost to the Owner. Use of surface mounted conduits and junction boxes as a repair method is unacceptable.
- o. Empty ENT runs shall be provided with a nylon pull string.
- p. Coordinate installation of raceway with structural steel and other structural members. Do not cut, notch or otherwise alter structural members without obtaining approval in writing from the Structural Engineer of record.
- q. No more than (2) 3/4" ENT conduits may cross each other within a horizontal concrete slab without obtaining approval in writing from the Structural Engineer of record.

B. Installation of 600-Volt Conductors:

1. All electrical wire, including signal circuits, shall be installed in conduit.
2. All circuits and feeder wires for all systems shall be continuous from over current protective device or switch to terminal or farthest outlet. No joints shall be made except in pull, junction or outlet boxes, or in panel or switchboard gutters.
 - a. Utilize preinsulated "winged" spring type connectors, 3M Company "Performance Plus" #O/B or #R/Y or equal as required for splices and taps in conductors #6 AWG and smaller. When a spring connector is used in an underground environment or when subject to moisture, utilize a 3M Company Scotchcast 3507G epoxy resin connector sealing pack to seal the spring connector. THE USE OF PUSH-WIRE CONNECTIORS (e.g. "WAGO" OR EQUIVILENT) IS STRICTLY PROHIBITED.
 - b. Wires #4 AWG and larger AWG shall be joined together as follows:
 - 1) When located in an underground environment or when subject to moisture, the splice shall be made with compression connector and sealed by a 3M, or equal, PST cold shrink connector insulator.
 - 2) When located in an interior environment, the splice shall be made with an IlSCO or equal dual rated, insulated splice-reducer connector or multi-tap connector-listed for use with 75/90 degree Celsius rated conductors.
 - c. Connections to busbar shall be made with dual-rated copper/aluminum one-piece compression lugs. Paralleled conductor connections shall be by mechanical lugs.
3. Thoroughly clean all conduit and wire-ways and see that all parts are perfectly dry before pulling any wires.
4. Install UL approved fixture wire from all lighting fixture lamp sockets into fixture outlet or junction box.
5. For 20A branch circuit wiring, increase #12 conductors to #10 for 120 volt circuits longer than 100 feet and for 277V circuits longer than 150 feet.
6. Conductor Support: Provide conductor supports as required by codes and recommended by cable manufacturer. Where required, provide cable supports in vertical conduits and provide lower end of conduit with a ventilator.

C. Grounding/Bonding:

1. Provide grounding and bonding for entire electric installation as shown on plans, as listed herein, and as required by applicable codes. Included, but not limited to, are items that require grounding/bonding:
 - a. Conduit, Raceways and Cable Trays.

- b. Neutral or identified conductors of interior wiring system.
 - c. Panel boards, Distribution Boards, Switchgear and Switchboards.
 - d. Non-current carrying metal parts of fixed equipment.
 - e. Telephone distribution equipment.
 - f. Transformers, Inverters, UPS, PDU, RDC, Transfer Switch and Generator Systems.
 - g. Raised Flooring.
 - h. Exposed metal in maintenance holes, hand holes.
 - i. Lightning Protection Systems and Antennas.
 - j. Metal piping installed in or attached to a building/structure.
 - k. Metallically isolated structural steel.
 - l. Metallically isolated underground metal water piping.
 - m. Elevator hydraulic piston/lift case.
2. In multi-occupancy buildings, Contractor shall bond metal water piping systems instated in, under or attached to a building and/or structure serving individual occupancies where the piping system(s) are metallically isolated from each other. Per NEC, or CEC where adopted ART. 250.104(A)(2) and (4), the bonding conductor shall be sized per Table 250.122 and connected to the switchboard/panel board serving that suite/occupancy.
3. Use of Ground Rods: Furnish and install required number of 3/4" x 10' copper clad ground rods to meet specified resistance, all required grounding wires, conduit and clamps. The size of the grounding conductors shall be not less than that set forth in the latest edition of the California Code of Regulations, Title 24, State of California and NEC (CEC, where adopted), unless otherwise indicated. Rods shall be installed such that at least 10 feet of length is in contact with the soil. Where rock bottom is encountered, the electrode shall be driven at an oblique angle not to exceed 45 degrees from vertical or shall be buried in a trench that is at least 30 inches deep. The upper end of the electrode shall be flush with or below ground level unless the above ground end and the grounding electrode conductor attachments are protected against physical damage. Unless otherwise noted, connection to the grounding electrode conductor may be by compression type or exothermic process connector. Mechanical connectors shall not be used.
4. Grounding System Connection:
- a. Compression connectors shall be unplated copper, manufactured by Burndy, or approved equal, designed specifically for the intended connection.

- b. Exothermic weld-type connectors shall be 'Cadweld' manufactured by Erico Products, or approved equal, designed specifically for the intended connection.
 - c. Mechanical connectors shall not be used.
- 5. Isolated Ground Receptacles shall have an insulated ground wire connected between the receptacle and the panelboard isolated ground bus. Unless otherwise noted, this ground wire shall not be grounded at any other point, and shall be distinguished from other ground wires by a continuous yellow stripe.
- 6. Provide separate green equipment ground conductor in all electrical raceways to effectively ground all fixtures, panels, controls, motors, disconnect switches, exterior lighting standards, and noncurrent carrying metallic enclosures. Use bonding jumpers, grounding bushings, lugs, busses, etc., for this purpose. Connect the equipment ground to the building system ground. Use the same size equipment ground conductors as phase conductors, up through #10 AWG. Use NEC (or CEC where adopted) Table 250.122 for conductor size with phase conductors #8 and larger, if not shown on the Drawings.
- 7. Clean the contact surfaces of all ground connections prior to making connections.
- 8. Ductwork: Provide a flexible ground strap, No. 6 AWG equivalent, at each flexible duct connection at each air handler, exhaust fan, and supply fan, and install to preclude vibration.
- 9. Motors: Connect the ground conductor to the conduit with an approved grounding bushing, and to the metal frame with a bolted solderless lug. Bolts, screws and washers shall be bronze or cadmium plated steel.
- 10. Building grounding system resistance to ground shall not exceed 25 ohms unless otherwise noted and should be confirmed by testing.
- D. Line Voltage and Low Voltage Power Supplies to all Mechanical Equipment Including Plumbing, Heating and Air Conditioning Units:
 - 1. An electric power supply, including conduit, any necessary junction and/or outlet boxes and conductors and connection shall be furnished and installed by the Contractor for each item or mechanical equipment.
 - 2. Power supplies to individual items of equipment shall be terminated in a suitable outlet or junction box adjacent to the respective item of equipment, or a junction box provided by the manufacturer or the equipment and directed by the Mechanical Contractor. Allow sufficient lengths of conductor at each location to permit connection to the individual equipment without breaking the wire run.
 - 3. The location of all conduit terminations to the equipment is approximate. The exact location of these conduit terminations shall be located and installed as directed by the Mechanical and Plumbing Contractor.

4. Provide power supplies to all plumbing and mechanical equipment, including but not limited to, equipment furnished and installed by Owner or Contractor such as heating and air conditioning equipment, pumps, boilers, auto valves, water coolers, trap primers etc. The installation shall produce a complete and operable system.
 5. Unless otherwise noted, the Contractor shall furnish and install all conduit, boxes, wires, etc., for line voltage wiring and low voltage wiring.
 6. It is the Contractor's responsibility to verify with the drawings of other trades regarding the extent of his responsibility for mechanical equipment. The bid must include a sum sufficient to cover the cost of the installation.
 7. The location of all power supply connection and/or terminations to the mechanical equipment is approximate. The exact locations of these terminations shall be verified with other trades during construction.
- E. Prefabricated Equipment: Installation of all prefabricated items and equipment shall conform to the requirements of the manufacturer's specifications and installation instruction pamphlets. Where code requirements affect installation of materials and equipment, the more stringent requirements, code or manufacturer's instructions and/or specifications, shall govern the work.
- F. Firestopping:
1. The Contractor shall be responsible for furnishing all material, labor, equipment, and services in conjunction with the selection and installation of a complete, fully functioning, code compliant, UL-listed, fire stop assembly/system(s) as required by project conditions.
 2. Each fire stop assembly/system shall have an "F" and/or "T" rating as required by each condition requiring fire stopping. Each fire stop assembly/system shall have a current UL listing, as indicated in the latest edition of the UL Fire Resistance Directory. Contractor shall verify acceptability of all fire stopping methods and system selections with the authority having jurisdiction prior to installation. The Contractor shall install each fire stop assembly/system in accordance with the manufacturer's printed instructions.
 3. Each fire stop assembly/system shall be labeled with fire stop manufacturer-furnished label on each side of the fire stopping systems depicting UL # etc.
- G. Housekeeping Pads
1. Provide a minimum 3" high housekeeping pad above finished floor/finished grade for all floor-mounted switchgear, switchboards, distribution boards, transformers, motor control centers, etc., flush with the face of the equipment. Located in mechanical central plant(s), other mechanical spaces, and located outdoors, pads shall be flush with the face of the equipment. Confirm pad dimensions with local inspector prior to forming pad to ensure any local code interpretations/conditions are met regarding housekeeping pads.

2. Unless otherwise noted above, provide a minimum 1-1/2" high housekeeping pad above finished floor/finished grade for all interior floor-mounted switchgear, switchboards, distribution boards, transformers, motor control centers, transfer switches etc., flush with the face of the equipment. All housekeeping pad heights are as measured from finished floor or grade. Confirm pad dimensions with local inspector prior to forming pad to ensure any local code interpretations/conditions are met regarding housekeeping pads.
3. Provide a 1-1/2" high housekeeping pad above finished floor/finished for service equipment. Prior to pad rough-in, Contractor shall verify serving utility company's maximum meter height requirements and, if necessary, adjust height of housekeeping pad to comply with those requirements. In indoor applications, the pad shall be flush with the face of the switchgear. In outdoor applications, the housekeeping pad shall extend a minimum of 4 feet from the front of switchgear/switchboard's weatherproof enclosure. Confirm pad dimensions with local inspector prior to forming pad to ensure any local code interpretations/conditions are met regarding housekeeping pads.
4. All housekeeping pads located in, on or attached to a building shall be seismically braced/connected to the building structure.

END OF SECTION

SECTION 27 10 00

STRUCTURED CABLING SYSTEM

PART 1 – GENERAL

1.1 SCOPE OF WORK

- A. The work under this section includes all final design, material, equipment, supplies, labor, testing, and accessories required to furnish and install a complete Structured Cabling System (SCS) as indicated on the drawings and as specified herein. These systems shall be defined as all cables, equipment, products, and etcetera, as indicated on the drawings and mentioned in these specifications.
- B. It is the intent of the Drawings and Specifications, which are presented in a "design-build" format, for the Contractor to design, provide and install a complete, fully operational and tested system.
- C. All miscellaneous system components including, but not limited to, cables, cable supports, termination equipment, punch blocks, patch panels, patch cords, device outlets, ladder runway, backboards, equipment racks, equipment cabinets, enclosures, terminal cabinets, equipment grounding, and any other related items shall be furnished and installed complete under this section, such that the system shall perform all functions listed herein in compliance with all of the specified requirements.
- D. Schedule is paramount to the project's success. With this, the Contractor will have to be a team player, continually working with the team to facilitate expeditious design, procurement, and construction processes.
- E. This project will be performed in a phased construction format. Each phase of construction will be completely installed, labeled and tested, to the greatest extent physically possible, before moving to the next phase.
- F. It is a mandatory requirement that a single Contractor perform the work described in the following specification sections:
 - 1. Section 27 10 00 Structured Cabling System

1.2 RELATED WORK, STANDARDS, DOCUMENTS AND PUBLICATIONS

- A. Each agency's relative codes, standards, and recommended practices apply to the voice/data cabling systems and their components as specified herein:
 - 1. American National Standards Institute (ANSI)
 - a. ANSI T1.404 Network and customer installation interfaces – DS3 and metallic interface specification
 - 2. Building Industry Consulting Service International (BICSI)

- a. Telecommunications Distribution Methods Manual (TDMM) – latest edition.
 - b. Customer-Owned Outside Plant Design Manual (CO-OSP) – latest edition.
3. Federal Communications Commission (FCC)
 - a. FCC Part 68 Rule
4. American Society for Testing and Materials (ASTM)
 - a. E814-02 Standard Test Method for Fire Tests of Through-Penetration Fire Stops
5. International Electrotechnical Commission (IEC)
 - a. IEC 61935-01 Generic Cabling Systems - Specification for the testing of balanced communication cabling in accordance with ISO/IEC 11801 Part 1: Installed Cabling
 - b. IEC 61935-02 Generic Cabling Systems - Specification for the testing of balanced communication cabling in accordance with ISO/IEC 11801 Part 2: Patch Cords and Work Area Cords
6. Institute of Electrical and Electronics Engineers (IEEE)
 - a. IEEE 802 Specification for Local Area Networks, latest edition.
 - b. IEEE 802.3an Specification for 10GBASE-T Ethernet, latest edition.
 - c. ANSI/IEEE C62.41 – Guide on the Surge Environment in Low-Voltage (1000V or less) AC Power Circuits, latest edition.
7. International Organization for Standardization (ISO)
 - a. ISO/IEC 11801 Information Technology – Generic Cabling for Customer Premises, latest edition.
 - b. ISO TR 24750 Technical Report
8. National Fire Protection Association (NFPA)
 - a. ANSI/NFPA-70 National Electric Code – Current version as adopted by AHJ(NEC), California Electric Code.
 - b. ANSI/NFPA-75 Standard for the protection of information technology equipment
9. National Electrical Manufacturers Association (NEMA)
10. Occupational Safety and Health Administration (OSHA)

11. Telecommunications Industry Association (TIA)
 - a. Optical Fibers Suitable for Manufacturing OM4 Cabled Optical Fiber.
 - b. TIA-526-7 Optical Power Loss of Installed Single-Mode Fiber Cable Plant.
 - c. TIA-526-14-B Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant; IEC 61280-4-1 Edition 2, Fiber-Optic Communications Subsystem Test Procedure- Part 4-1: Installed Cable Plant- Multimode Attenuation Measurement.
 - d. TIA-568-C.0 Telecommunications Cabling for Customer Premises, latest edition.
 - e. TIA-568-C.1 Commercial Building Telecommunications Cabling Standard
 - f. TIA-568-C.2 Twisted-Pair Telecommunications Cabling and Components Standard, latest edition.
 - g. TIA-568-C.3 Optical Fiber Cabling Components Standard, latest edition.
 - h. TIA-568-C.4 Broadband Coaxial Cabling and Components Standard
 - i. TIA-569-C Telecommunications Pathways and Spaces, latest edition.
 - j. TIA-598-C Optical Fiber Cable Color Coding.
 - k. TIA-606-B Administration Standard for Commercial Telecommunications Infrastructure, latest edition.
 - l. TIA-607-B Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, latest edition.
 - m. TIA-758-B Customer-Owned Outside Plant Telecommunications Infrastructure Standard, latest edition.
 - n. TIA-862-A Building Automation Systems Cabling Standard, latest edition.
 - o. TIA-942-A Telecommunications Infrastructure Standard for Data Centers
 - p. TIA-1152 Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling, latest edition.
12. Underwriters Laboratories Standards (UL)
 - a. UL 5 Surface Metal Raceways and Fittings, latest edition.
 - b. UL 5A Nonmetallic Surface Raceways and Fittings, latest edition.

- c. UL 5B Strut-Type Channel Raceways and Fittings, latest edition.
 - d. UL 5C Surface Raceways and Fittings for Use with Data, Signal, and Control Circuits, latest edition.
 - e. UL 514A Metallic Outlet Boxes, latest edition.
 - f. UL 514B Conduit, Tubing, and Cable Fittings, latest edition.
 - g. UL 514C Nonmetallic Outlet Boxes, Flush-Device Boxes, Covers, latest edition.
 - h. UL 514D Cover Plates for Flush-Mounted Wiring Devices, latest edition.
 - i. UL 1685 Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables, latest edition.
 - j. UL 1863 Communications-Circuit Accessories, latest edition.
13. Intertek Testing Services ETL SEMKO (ETL)
- B. The Contractor shall be responsible for obtaining and utilizing the latest Structured Cabling, Architectural, Security and Electrical plans.

1.3 GENERAL REQUIREMENTS

- A. Manufacturer: The term “manufacturer” shall be defined as the company, or group of companies, that actually produces the products meeting the requirements of Section 2 of this document. The manufacturer shall have a minimum of seven (7) years’ experience in manufacturing products of this type and shall be ISO 9001 Certified. The products, summarized in this specification, shall be supplied by a single manufacturer, except for:
- 1. Data racks and other hardware that is not defined as part of the copper cable channel test configuration by TIA-568-C.
 - 2. Fiber Optic Cable and Outside plant (OSP) fiber optic cable.
 - 3. Channel solutions consisting of cabling and connectivity hardware independently tested as by UL or ETL and that are listed Section 2 of this document.
 - 4. Cables manufactured by another manufacturer specifically called out on the drawings.
- B. Contractor: The term “Contractor” shall be defined as the company, or group of companies, that actually provides the products per Section 2 and installs the products per Section 3 of this document. The Contractor selected to provide the installation of this system shall be certified by the manufacturer in all aspects of design, installation and testing of the products described herein.

1. The Contractor shall hold a valid State of California C-7 Low-Voltage license, shall have completed at least ten (10) projects of equal scope, shall have been in business of furnishing and installing systems of this scope and magnitude for at least the past five (5) consecutive years, and capable of being bonded to assure the Owner's Project Manager of performance and satisfactory service during the guarantee period.
2. The Contractor shall have a minimum of one (1) Registered Communications Distribution Designer (BICSI RCDD) and a minimum of one (1) BICSI Technician level installer on staff as full-time employees.
3. All work shall be performed under the supervision of a company accredited and trained by the manufacturer and such accreditation must be presented with the bid submittal. Contractor must be accredited a minimum of 180 days prior to bid submittal date.
4. The Contractor shall be a manufacturer's Authorized Installer and Warranty Station for the equipment offered and shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment.
5. All personnel performing work on this project must have successfully completed the manufacturer's training course prior to performance of any work on this project. Accreditation will consist of individual employee certifications issued by the manufacturer. All personnel engaged in the testing of fiber optic and category-6 metallic premise horizontal and distribution systems must have successfully completed the test equipment manufacturer's training. Certification of such training must be presented with the bid submittal.
6. The Contractor selected for this Project shall adhere to the engineering, installation and testing procedures and utilize the authorized manufacturer components and distribution channels in provisioning this Project.
7. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of fiber optic cable, and Categories 6 and 6A metallic premise horizontal and distribution systems and have personnel who are manufacturer- trained in the use of such testing tools and equipment.
8. The Contractor shall hold all other licenses required by the legally constituted authorities having jurisdiction (AHJ) over the work.
9. The Contractor shall maintain and provide appropriate liability and worker's compensation insurance coverage.
10. For additional Contractor requirements, see Section 1.06 of this document in its entirety.

1.4 QUALITY ASSURANCE

- A. It is the intent of these specifications to establish an installation standard of quality for labor and materials.

- B. Products specified by a particular Manufacturer's name and followed by the words "no equal" shall be provided by the Contractor and no substitution will be accepted. These products shall be provided to match other products in use on this site, in accordance with Public Contract Code 3400 (b)(2).
- C. For any proposed product substitution, or when the Contractor intends to include a "Substitution / Or-Equal" product in the bid pricing, the Contractor shall provide a "Substitution / Or-Equal Request" submittal to the Owner's Project Manager for review no later than ten (10) calendar days prior to Bid submittal. This report shall include *all* the following items:
 - 1. Description of how the proposed product(s) will impact meeting the project completion date, indicate all item(s) with lead times and expected delivery date(s).
 - 2. Itemized cost comparisons between the proposed product(s) and the listed product(s).
 - 3. Detailed technical analysis of the electrical and mechanical specification differences between the proposed product(s) and the listed product(s).
 - 4. Provide either ETL "Verified" or UL "Verified" test lab documentation for the proposed product(s) and assemblies proposed.
 - 5. Proposed product identification, manufacturer literature (specifications and cut sheets).
 - 6. Name, address, and contact information of several (minimum of two) similar projects where the substituted product(s) have been used.
 - 7. Name, address, and contact information of the proposed product(s) manufacturer's local representative.
 - 8. Sample proposed product(s) manufacturer's component and application extended warranty. Detailed warranty requirements are described in Section 1.10 General System Product Warranty of this document.
- D. Failure to provide *all* items listed in Section 1.4.A.1 through 8 for review by the Owner's Design Team shall result in rejection of the substitution/or-equal request.
- E. The Contractor's bid shall include pricing for all specified products called out in the bid documents. The Contractor's bid shall also include alternate pricing for any proposed Substitution/Or-Equal products.
- F. The Owner's Design Team/Project Manager must approve any proposed product(s) substitution/or-equal item in writing. The Owner's Design Team/Project Manager reserves the right to require a complete sample of any proposed product(s) and may request a sample tested by an independent testing consultant to prove equality. The decision of the Owner's Design Team/Project Manager regarding equality of proposed product(s) items will be final.

- G. If a proposed product(s) is given final acceptance by the Owner's Project Manager, the Contractor shall reimburse the Owner's Design Team/Project Manager for the costs to review the proposed product(s) substitution(s), and for any additional engineering charges, and shall pay all charges of other trades resulting from this products use, at no cost to the Owner.

1.5 GENERAL SUBMITTAL REQUIREMENT

- A. Submittals shall be presented and formatted per the guidelines in the Division 1 section of this bid package.
- B. All cut sheets shall represent the latest version, part number, and revision of the product. Where multiple products or part numbers appear on a page, a bold arrow or circle shall indicate which product or part numbers are to be used as part of the installation. The submittal shall include all descriptive pages associated with the product, not just the page showing the part number. Contractor submittal shall include a materials list. Cut sheets shall be numbered by and match page numbers of each item included on the material list.

1.6 PRE-INSTALLATION SUBMITTAL REQUIREMENTS

- A. Within fifteen (15) calendar days after the date of award of the Contract, the Contractor shall submit the following:
 - 1. Submittal Binder: Submit one (1) hard copy and one (1) electronic copy of the complete Submittal Binder to the Project Engineer for review. The binder shall consist of five (5) major sections with each section separated by Index Tabs. Each page in the binder shall be numbered sequentially and shall be summarized in the Index.
 - a. The FIRST section shall include the following items:
 - 1) The TITLE SHEET which shall include the Submittal Date, Project Title and Address, Contractor's Name and contact information, and name of the Owner.
 - 2) The INDEX sheet which shall list each item included in the binder along with the page number where it may be found.
 - b. The SECOND section shall include the following items:
 - 1) CONTRACTOR'S LICENSE: A copy of the low voltage Contractor's valid State of California C-7 Low-Voltage license.
 - 2) PROOF OF EXPERIENCE: Proof (written documentation) that the low voltage Contractor has been regularly engaged in the business of low voltage contracting consisting of, but not limited to, engineering, fabrication, installation, and servicing of communication systems of the type specified herein for at least the past five (5) consecutive years.

- 3) **PENDING LITIGATION:** Provide a statement summarizing any pending litigation involving any officer or principal of/or the company, the nature of the litigation and what effect the litigation may carry as it relates to this work in the worst-case scenario. Non-disclosure of this item, if later discovered, may result, at the Owner's discretion, in the Contractor bearing all costs and any cost related to the associated delays in the progress of the work.
- 4) **INSURANCE CERTIFICATES:** Copy of low voltage Contractor's current liability insurance, workers compensation, and state industrial insurance certificates in conformance with the contract documents.
- 5) **PROJECT LIST:** A List containing at least ten (10) California installations completed within the last five (5) years by the low voltage Contractor that are comparable in scope and nature to that specified in the contract document. Provide up to date contact information for each project listed including contact name, title, email address and phone number.
- 6) **SERVICE CAPABILITY:** Documentation indicating in detail that the low voltage Contractor has competent engineering, installation, service personnel and facilities with reasonable stock of service parts within 75 air miles of the job site. Do not submit a sales brochure as documentation.
- 7) **AUTHORIZATION LETTERS:** Letters from the low voltage equipment manufacturer stating that the low voltage bidding Contractor is a Factory Authorized Distributor/Installer and is trained and certified for the equipment he proposes to use on this project and is licensed to purchase and install software required to provide the specified functions.
- 8) **CERTIFICATION:** Copy of the following current BICSI certifications. Provide proof that the certificate holders are full time employees of the low voltage Contractor's local facility servicing this project and will be actively involved on site for the duration of this project.
 - a) **BICSI RCDD,** minimum of (1). Mandatory requirement: Shall be on site a minimum of one (1) day per workweek.
 - b) **BICSI TECHNICIAN,** minimum of (1). Mandatory requirement: Shall be on site a minimum of five (5) full 8-hour days per workweek.
- 9) **PROOF OF TRAINED PERSONNEL:** Documentation that the Contractor has full time on-staff personnel, manufacturer trained and BICSI certified, for the equipment proposed for this project, and on-staff manufacturer trained and certified by the Test Equipment manufacturer in the proper use of the test equipment

required on this project. Provide copies of all manufacturers' training/certification documentation, and Test Equipment manufacturer's training/certification documentation. Provide a statement that personnel meeting these qualifications are in the local facility and will be maintained at that facility throughout the project and the warranty period.

- 10) DOJ FINGERPRINTING: A fingerprint check must be provided for all personnel working on school sites, performed by the Department of Justice, pursuant to California Education Code Section 45125.1. Fingerprinting shall be performed prior to start of project. All costs associated with DOJ fingerprinting/background checks shall be the full responsibility of the Contractor.
- c. The THIRD section shall contain a detailed bill of materials including the quantity, product Manufacturer, product part number, product description, and corresponding specification section number or drawing sheet number where that product is referenced. Also listed in the Contractor's bill of materials shall be each item of test equipment to be used to test the optical fiber, copper, and coax components. Include all patch cords and other specialized components. See example format below:

Description	Part #	Quantity	UoM	Spec	Test Equip.
CAT6 Station cable	Brand X #12345	100 boxes	1000ft/box	2.03	Fluke DTX-1800

This information may be used by the Owner to evaluate the Contractor's general understanding of the project scope during the bid evaluation. Errors or omissions from this bill of material do not relieve the Contractor from providing all material, components, labor, and etcetera, as outlined in this specification and on the drawings to provide a complete and useable structured cabling system.

- d. The FOURTH section shall contain original manufacturer cut sheets for all of the materials that meet the requirements listed in Section 2 of this specification and all materials described on the construction drawings. Also include manufacturer's cut sheets for all testing equipment to be used for completion of the project. All pages shall be numbered sequentially corresponding to the bill of materials. On each cut-sheet, provide an indicating arrow next to each part number of proposed material.
- e. The FIFTH section shall contain a designation schedule for each system component location and complete full size 30" x 42" (unless otherwise specified) bond drawings (shop drawings), showing system wiring plans. The professionally drafted drawings shall be generated on AutoDesk AutoCAD 2010 (or later) computer design software. These drawings shall also include:

- 1) MDF and IDF Diagrams - Including:
 - a) Cable routing
 - b) Position of all devices, components, and apparatus
 - c) Detailed elevation layout of the wall field(s)
 - d) Labeling plan (see District labeling requirements)
- 2) Site Plan – Including:
 - a) Conduit routing of all site conduits including size and quantity
 - b) Building designations
 - c) MDF and IDF locations
 - d) Campus cabling and conduit between MDF and IDF racks including cable type and quantity
- 3) Work Area Floor Plans - Including:
 - a) Detailed cable routes including cable type and quantity
 - b) Device locations and quantities with labeling
 - c) Work area labeling plan (see District labeling requirements)
- 4) Cross Connect Documentation - Including:
 - a) Cross-connect records for all voice and data devices
 - b) Cross-connect records may be in either Excel or Word format
- 5) Riser Distribution Plan
- 6) Rack elevations of all MDF and IDF equipment
- 7) 1/4-inch scale floor plans of all data rooms (MDF, IDF, MPOE, etc.)
 - a) Identify all equipment racks, cabinets, terminals, cross connect locations, ground bus bar, and all other components in room(s).
- 8) Cable Tray, Conduit, and Raceway Plans (if applicable)
 - a) Provide 1/4-inch scale ladder runway plan for all data rooms.

- b) Provide scaled plans for all in-building conduit and raceway.
- B. Failure to comply with any of the requirements listed above may result in the rejection of the entire submittal package.

1.7 PROJECT DIRECTION

- A. Single Point of Contact: Contractor shall provide an English-proficient, single point of contact, i.e., Project Manager, to speak for the Contractor and shall provide the following functions:
1. Initiate and coordinate tasks with Owner's Project Manager, and others as specified by Owner's Project Manager.
 2. Provide day-to-day direction and on-site supervision of Contractor personnel.
 3. Shall be readily available to the Owner/Owner's Project Manager 24 hours a day / 7 days a week throughout the duration of the Project.
 4. Shall have full time cellular phone capability, and the ability to send/receive email correspondence, accessible by the Owner's Project Manager.
 5. Ensure conformance with all Contract provisions.
 6. Participate in weekly site project meetings and construction meetings.
 7. Provide detailed and written weekly status reports to Owner's Project Manager. The content shall be substantive enough to bring about a full understanding of all situations current and situations future. Weekly reports shall include but are not limited to detailed progress report, RFI status log (Request for Information), Change Order Log (pending and approved), Project Addendum log, and a two-week look ahead work calendar. Each of the above must show assigned responsibilities and event history. Weekly reports shall include milestone information, resource updates (staff and materials), and any conditions or incidents that may impact the Project Schedule.
 8. This individual shall remain as Project Manager for the duration of the project. The Contractor may change Project Managers only with the Owner's Project Manager's written approval.

1.8 PLANNING

- A. Planning meetings and schedule: Within fifteen (15) calendar days after the date of award of the Contract, an initial planning meeting will be held with the successful bidder to clarify all requirements (systems, services, distribution methods, etc.), identify responsibilities, and schedule the events that will transpire during the implementation of the project. Within seven (7) calendar days of this initial meeting, the Contractor shall provide a written report and project schedule to clearly document the events and responsibilities associated with the project. Contractor's project schedule shall conform to the overall Project Construction Schedule issued by the Construction Management Company or the Owner. Contractor is required to

attend all planning and other construction meetings as requested by the Owner, Architect, or Engineer of Record.

1.9 POST INSTALLATION SUBMITTAL REQUIREMENTS

- A. Within fifteen (15) calendar days after the completion of work, the Contractor shall submit the following:
 - 1. Record Documentation:
 - a. Final Test Results – Test results for each cable indicating tests performed, results obtained, and values measured. Test results shall be provided in electronic format with the associated application (if required) for viewing. Contractor shall provide individual test results for each cable tested, and a summary sheet listing all cables, test summary, lengths, and the total cable count. Provide test reports for all copper cables and fiber optic cables. Testing shall be conducted in accordance with Section 3.06 of this document.
 - b. As-Built records – Contractor shall create and provide all backgrounds and floor plans in AutoCAD or Revit file format. Sheet borders shall be either provided by, or approved by, the Architect. Contractor's as-built records shall include all of the items described and listed in section 1.6.A.1.e of this document.
- B. After as-built submittal is approved by Owner, the Contractor shall provide two (2) sets of CDs containing all post-installation submittals and close out documentation in AutoCAD (or Revit) format; and in PDF, Word, or Excel formats as required elsewhere in this document.
- C. As-Built Documentation Display in Each MDF and IDF: Within fifteen (15) days after the completion of work, the Contractor shall install a complete Contractor-provided, professionally drafted as-built floor plan in color in each MDF and IDF mounting frame. Each floor plan, generated on AutoDesk AutoCAD computer design software and printed in color, shall depict all jack locations in each modular furniture cubicle and all other areas. Also depicted shall be speaker, clock, wireless access point, terminal cabinets, MDF, IDF, pull boxes, vaults, CCTV cameras, television jack locations, or any other communications outlet cables by the Contractor. All jack locations shall be color coordinated with the Owner's labeling scheme as described elsewhere in this specification. Contractor's device symbols shall match the device symbols utilized on the bid documents. The Contractor will provide to Owner two (2) sets of CDs containing all as-built records in AutoCAD (.dwg) or Revit (.rvt) format, and full-size PDF format.
- D. Warranty Documentation
 - 1. Contractor shall apply for all Manufacturers' Extended Warranties on behalf of the Owner. Contractor shall present to Owner all product Warranty documents per General System Product Warranty Section of this document. Warranty shall commence after final acceptance of System and Project Close Out by the Owner.

1.10 GENERAL SYSTEM PRODUCT WARRANTY

- A. The horizontal communications cabling system installed shall be eligible for coverage by a Limited Lifetime Warranty to the District.
 - 1. Horizontal channels shall be completed with Leviton Network Solutions factory-terminated copper and/or fiber optic patch cords in order to be eligible for the applicable Berk-Tek or Leviton Warranty with Channel Performance guarantees.
 - 2. Approved product shall be listed on the most recent version of the applicable Berk-Tek Leviton Technologies data sheets for each Berk-Tek Leviton Technologies solution.
- B. Optimized Installer/Optimized Integrator shall provide labor, materials, and documentation in accordance with Berk-Tek and Leviton Network Solutions requirements necessary to ensure that the Owner will be furnished with a Limited Lifetime Warranty.
- C. The installed structured cabling system shall provide a warranty guaranteeing installed channel performance above the ANSI/TIA 568-C requirements for Category 5e, Category 6, and Category 6A cabling systems or ISO 11801 requirements for Class D, Class E, and/or Class Ea. Standards-compliant channel performance tests shall be performed in the field with a Berk-Tek Leviton Technologies approved certification tester in the appropriate channel test configuration. See 1.10. A.1 above for channel requirements.
- D. Necessary documentation for warranty registration shall be provided to the manufacturer by the Contractor (within 10 days) following 100 percent testing of cables. Contractor shall submit test results to Leviton Network Solutions or to BerkTek, in the certification test analyzer's original software files. Contractor shall ensure that the warranty registration is properly submitted, with all required documentation within ten (10) days of project completion. Contractor must adhere to the terms and conditions of the respective manufacturer's warranty programs.
- E. Installer shall ensure that the Owner receives the manufacturer issued project warranty certificate within sixty (60) calendar days of warranty registration.
- F. The first usage date shall be agreed to be in writing by the District and Contractor within five (5) working days of first usage. During this time, the entire system must be kept in proper operating condition at no additional cost to the District.
- G. Cable Manufacturer "site certifications" are prohibited.

1.11 GENERAL ENGINEERING AND DESIGN GUIDELINES

- A. Cabling System Installation Practices
 - 1. Plastic cable tie (tie wrap) devices shall *not* be utilized at any time. Only Plenum-rated Velcro-type hook-and-loop strap devices are permitted. In the MDF and IDF rooms, all vertically run cables and conductors shall be secured

with Velcro at a maximum interval of eighteen (18) inches, and all horizontally run cables and conductors shall be secured with Velcro at a maximum interval of eighteen (18) inches.

2. In the MDF and IDF rooms, all vertically run innerduct shall be secured with Velcro at a maximum interval of eighteen (18) inch intervals. Innerduct installed on ladder runway shall be supported horizontally and vertically at a maximum of eighteen (18) inch intervals.
3. All horizontally run innerduct shall be secured with Velcro at a maximum interval of forty-eight (48) inches when installed horizontal above accessible ceiling spaces or open ceiling spaces.
4. All cables installed above accessible ceiling spaces shall be independently supported.
5. A pull rope is to be installed and/or replaced in all pathways for future use.
6. All intra-building cabling shall be routed either parallel or at right angles to the building structure and/or walls.
7. No cabling is to be pulled through electrical conduit bodies (Condulets) devices. If conduit body devices are pre- existing and it is determined, at the review of the Owner's representative, that sufficient space in the conduit is available and the Owner provides written approval to utilize the Condulet, the Contractor shall remove the Condulet cap, pull the cable to and beyond the cap then carefully reinstall the cap.
8. Communications cabling shall never be tied or attached to the exterior of electrical conduits, power cables or devices, lighting systems, or co-exist inside any pathway with power cabling.
9. Any visible damage to a cable such as kinks or bends in violation of the minimum bend radius shall render the cable segment defective and shall be removed and replaced by the Contractor at no additional cost to the Owner.
10. All materials shall be new, unused, and delivered to job site in original manufacturer or distributor cartons or packages. No previously installed material shall be used at any time.
11. Reference Part 3 of this document for additional installation guidelines and requirements.

PART 2 – PRODUCTS

2.1 STRUCTURED CABLING SYSTEM

- A. Acceptable Manufacturers - all equipment listed herein shall be by:
 1. SCS components (faceplates, jacks, patch panels): Panduit, no equal.

2. Copper Category 6 and 6A Cable: General Cable, no equal.
 3. Fiber Optic Cable: General Cable, no equal.
 4. Fiber Optic Enclosures/Panels: Panduit, no equal.
 5. Fiber Optic Connectors: Panduit, no equal.
 6. Riser and OSP Copper Cable: Superior Essex or approved equal.
 7. Ladder Runway: B-Line or Chatsworth, no equal.
 8. Equipment Racks, Cabinets: B-Line or Chatsworth, no equal.
 9. Protectors: Circa, Emerson or approved equal.
- B. It is the responsibility of the bidder to ensure that the proposed product meets or exceeds every standard set forth in these specifications and the equipment's technical data sheets.
- C. The functions and features specified are vital to the operation of this facility; therefore, inclusion of a component's manufacturer in the list of acceptable manufacturers does not release the Contractor from strict compliance with the requirements of this specification.

2.2 OUTLETS

- A. Telecommunications outlets (TO) shall consist of one- or two-gang utility outlet boxes equipped with 8-pin modular (RJ-45) jacks utilizing the T568B wiring scheme and a faceplate. All outlet cabling shall terminate on patch panels at their associated Main Distribution Frame (MDF) room, Intermediate Distribution Frame (IDF) Rooms, or as otherwise indicated on the drawings.
- B. Faceplates
1. All Faceplates shall be available in duplex, quad, or six-plex configuration in a single-gang form.
 2. Surface mount boxes shall be available in dual, quad, and six-plex configuration.
 3. Modular furniture faceplates shall be available in dual and quad configuration for the Owner's modular existing and/or new modular furniture. Faceplates shall be flush-mounted in the modular furniture. Surface mounted boxes/faceplates are unacceptable. The Contractor is responsible for coordinating with the Owner's modular furniture Contractor to determine faceplate requirements. The Contractor shall provide and install all parts/fittings necessary to meet the requirements of this section.
 4. Wall mounted phone jack faceplates shall be single gang configuration, constructed of stainless steel and have two standard phone mounting posts

located above and below the jack opening. Wall mounted phone faceplates will consist of 8p8c modular (RJ-45) jacks.

5. Faceplates shall have two (2) designation windows, one located at top, and one located at bottom. Designation windows shall be equipped with clear plastic covers to house machine-generated labels.
6. Color of faceplates shall be White, unless otherwise noted.
7. Provide blank faceplate inserts for all unused outlet locations within the faceplate.
8. Product Specification: Panduit, 2-port #CFPL2WHY, 4-port #CFPL4WHY

C. Category 6 Gigabit jacks

1. All voice and data jacks shall be 8-position/8-conductor (8p8c) modular RJ-45 jacks incorporating 110-style rear termination lugs for termination of Category 6 cable, utilize a T568B wiring scheme, and be constructed of high impact thermoplastic housing rated for Category 6 service.
2. All Category 6 jacks shall meet or exceed Category 6 transmission requirements for connecting hardware, as specified in TIA-568-C Commercial Building Telecommunications Cabling Standard.
3. Category 6 jacks shall be channel-rated.
4. Category 6 jacks shall be capable of being in a modular patching situation or as a modular telecommunication outlet (TO) supporting current 10Base-T, Token Ring, 100 Mbps TP-PMD, 155 Mbps ATM, 622 Mbps ATM using parallel transmission schemes and evolving high-speed, high-bandwidth applications, including Ethernet, 1000BASE-T and 1.2 Gbps ATM.
5. Category 6 jack color shall be Blue
6. The jacks shall accommodate UTP cable and work in concert with non-metallic Wiremold 2300 or 5400 series raceway.
7. Product Specification: Panduit Mini-Com TX6 #CJ688TGBU

D. Category 6A 10-Gigabit jacks

1. All category 6A jacks shall be 8-position/8-conductor (8p8c) modular RJ-45 jacks incorporating 110-style rear termination lugs for termination of Category 6A cable, T568B wiring type, with a connector body made of high-impact fire-retardant plastic.
2. Category-6A jacks shall be channel-rated.
3. All Category 6A jacks shall meet or exceed TIA-568-C.2 component Cat 6A requirements for connecting hardware from 1MHz to 500MHz, 10 GB/s.

4. Category 6A jacks shall include a pair separation tower to facilitate required conductor separation.
5. Category 6A jack color shall be Yellow
6. Category 6A jacks shall be utilized for all wireless access point outlet locations.
7. Category 6A jacks shall only be terminated on Category 6A cables.
8. Product Specification: Panduit Mini-Com TG #CJ6X88TGYL

2.3 STATION CABLE

- A. Station cables shall extend between the station location (TO) and its associated MDF/IDF.
- B. Category 6 premium station cable:
 1. The Category 6 premium cable shall consist of 4-pair, 23-AWG bare copper twisted pairs, unshielded, UTP, and shall be of the traditional round design.
 2. Category 6 cable must pass factory tests with a minimum of 10dB of crosstalk margin beyond the category 6 standard for NEXT, PSNEXT, ACT and PSACR.
 3. Cable shall be characterized to 600MHz, 350MHz greater than the standard.
 4. The cable jacket shall be Plenum rated.
 5. Color of cable shall be Blue.
 6. Category 6 cable shall be terminated on category 6 jacks and category 6 patch panels.
 7. Product Specification: General Cable GenSpeed #7131800
- C. Category 6A 10-Gigabit station cable
 1. The Category 6 Augmented (6A) cable shall consist of 4-pair, 23-AWG bare copper twisted pairs with a UTP design.
 2. The cable jacket shall be rated for the environment in which it is installed. Install CMP cable in plenum-rated spaces, CMR cable in riser-rated spaces, and OSP cable in outdoor and underground conduit spaces.
 3. Category 6A cable shall be ETL verified to TIA-568-C.2-10 Category 6A, and support 10GBASE-T IEEE 802.3an standard of 10 GB/s up to 500MHz.
 4. Color of cable shall be Yellow.

5. Category 6A cable shall only be terminated on Category 6A-rated jacks and patch panels.
6. Product Specification: General Cable GenSpeed #7141822

2.4 MODULAR PATCH PANEL SYSTEM – CATEGORY 6 AND CATEGORY 6A

- A. The termination block shall support the appropriate emerging high-bandwidth applications, including 1 Gbps Ethernet, potentially 1.2 Gbps ATM and 2.4 Gbps ATM, Multi-Tasked Split Screen Computing, Virtual Holographic Video Conferencing, Instant Access Telemedicine, 3D CAD/CAM Engineering, and Internet-Intranet Communications/ Commerce, as well as all 77 channels (550 MHz) of analog broad band video, including 1000 Mbps Ethernet and potentially 1.2 Gbps ATM, and facilitate cross connection and inter connection using modular patch cords.
- B. All Modular jack panels shall be wired to ANSI/TIA/EIA 568-C using T568B wiring scheme.
- C. The wiring block shall be able to accommodate 23 AWG cable conductors.
- D. The Category 6 modular jack panels shall meet or exceed the Category 6 standards requirements in ISO/IEC 11801 and ANSI/TIA/EIA. They shall also be UL Listed.
- E. Contractor shall provide Category 6 modular patch panels in sufficient quantities to terminate all category 6 cables.
- F. Contractor shall provide Category 6A modular jack panels in sufficient quantities to terminate all category 6A cables.
- G. All patch panels shall have two (2) cable strain relief/management bars (Leviton #49005-CMB or equal) installed at the rear of the panel to support the terminated horizontal cabling.
- H. Contractor shall provide and install a 2RU horizontal wire manager immediately below each 2RU patch panel. Contractor shall provide and install a 1RU horizontal wire manager immediately below each 1RU patch panel. A 1RU space shall be left open immediately below the horizontal wire manager before mounting the next patch panel. This space is reserved for installation of a 1RU network switch to service all ports on the patch panel immediately above the horizontal wire manager.
- I. Product Specification: Panduit, Cat-6 24-port #DP24688TGY, Cat-6A 24-port #DP246X88TGY.

2.5 PATCH CORDS / STATION CORDS - CATEGORY 6 AND CATEGORY 6A

- A. Provide Category 6 modular patch cords for each port on the cat-6 patch panel and for each cat-6 outlet in the station locations.
- B. Provide Category 6A modular patch cords for each port on the cat-6A patch panel and for each cat-6A outlet in the station locations.

- C. Patch cords shall be equipped with an 8-pin 8-conductor modular connector on each end and shall conform to the length(s) specified. All cords shall be wired to T568B wiring scheme. All cords shall be factory-built by the cable manufacturer. Fabrication of cords in the field is prohibited.
- D. All category 6 patch cords shall exceed ANSI/TIA/EIA and ISO/IEC Category 6/Class E specifications. Category 6A patch cords shall exceed ANSI/TIA/EIA and ISO/IEC Category 6A specifications.
- E. At the MDF and each IDF, unless otherwise noted, provide one (1) 5-foot cat-6 patch cord for each cat-6 cable terminated in the cat-6 patch panels, and provide one (1) 5-foot cat-6A patch cord for each cat-6A cable terminated in the cat-6A patch panels.
- F. At wall mounted IDF cabinets, provide one (1) 3-foot (1 meter) cat-6 patch cord for each cat-6 cable terminated in the cat-6 patch panels, and provide one (1) 3-foot (1 meter) cat-6A patch cord for each cat-6A cable terminated in the cat-6A patch panels.
- G. At the workstations, provide one (1) 9-foot (3 meter) cat-6 patch cord for each cat-6 cable terminated at a cat-6 outlet, and provide one (1) 9-foot (3 meter) cat-6A patch cord for each cat-6A cable terminated at a cat-6A outlet. Where the specifications and the plan drawings conflict, the more stringent requirement will apply.
- H. Contractor shall verify all patch cord color and length requirements with Owner prior to ordering material. Include all costs in base bid.
- I. All patch cords shall meet or exceed the performance criteria of the category 6 or 6A cable to which it is connected.
- J. Category 6 patch cords shall be UL Verified for ANSI/TIA/EIA 568-C Electrical Performance.
- K. Category 6A patch cords shall be provided at all Category 6A patch panels and outlets.
- L. Product Specification:
 - 1. Panduit, TX6, Cat-6, #UTPSP1MBUY (1m), #UTPSP3MBUY (3m)
 - 2. Panduit, TX6A, Cat-6A, #UTP6AX1MBU (1m), #UTP6AX3MBU (3m)

2.6 FIBER OPTIC CABLING

- A. 12-strand, OS2, 8.3 - 9 micron, single-mode fibers.
- B. Fiber optic cable shall meet or exceed ANSI/EIA/TIA-492 specifications and ISO/IEC 11801 standards.
- C. All fibers shall be color coded to facilitate individual fiber identification per TIA/EIA 569-B.

- D. All fiber optic cable installed inside buildings shall be installed within Contractor-provided innerduct. Innerduct shall be rated for the environment in which it is installed. Innerduct shall be Orange in color, unless otherwise noted in the bid documents/plan drawings.
- E. Outdoor-rated and installed cables shall be tight buffered construction.
- F. Cable shall be "indoor-outdoor-plenum-rated" OFNP cable.
- G. Provide buffer tube fan out kits as required.
- H. Product Specification:
 - 1. General Cable, AP0121ANU.BK

2.7 FIBER OPTIC PATCH CORDS

- A. Fiber patch Cords shall be available in duplex multi-mode.
- B. Construction shall be either 3.0 mm cordage or 1.6 mm cordage.
- C. Connectors shall be available in Duplex LC and SC. Verify with Owner prior to ordering materials.
- D. The single-mode fiber optic solution shall utilize factory-made patch cords.
- E. At the MDF and at each IDF room, provide a minimum of two (2) 1-meter SC to SC duplex single-mode fiber optic patch cords for every 6-strands of single-mode fiber installed. Verify patch cord length and connector types with District in field prior to ordering product.

2.8 FIBER DISTRIBUTION CENTER (FDC)/FIBER PATCH PANEL

- A. Fiber Patch Panels/Enclosures: A rack mount or wall mount enclosure that terminates, provides cross connection, interconnection, and splicing and fiber identification from 18 to 360 fiber strands. The shelf will provide protection from mechanical stress on the cable and fibers and from macro-bending losses.
 - 1. The shelf shall be wall or rack mountable depending on the location requirement. The units must fit into a 19" wide frame arrangement and have an integrated jumper routing trough.
 - 2. When wall mounted, the shelf shall consist of a modular enclosure with front and side access and can be fully administered from the front. Wall mount enclosure shall include adjustable fiber management rings, and be constructed of 16-gauge steel, power coated black.
 - 3. The rack mounted enclosure shall provide front and rear access doors and can be fully administered from the front and rear. The unit shall have integrated sliding tray to allow bulkhead to glide forward or backward after installation.

4. The rack mounted enclosure shall have a transparent hinged front cover to allow visibility of interior after install.
5. Rack mount enclosures shall be available in 1U, 2U and 4U sizes for 19"-wide racks and made of 16-gauge steel power coated.
6. The adapter/connector plates shall snap into the front of the enclosure and accommodate LC connectors as required. Adapter plates shall utilize ceramic sleeves. Multimode adapter plates shall be aqua in color. Single mode adapter plates shall be blue in color.
7. Provide one (1) 6-port LC duplex Aqua colored adapter panel for every 12-strands of multimode fiber optic cable installed.
8. Provide (1) 6-port LC duplex Green colored adapter panel for every 6-strands of single mode fiber optic cable installed.
9. Fiber patch panel/shelf shall be labeled according to the Owner's specific requirements.
10. Provide quantity of enclosures and adapter panels as required to terminate all strands.
11. Provide blank molded plates to cover all unused panel openings.
12. Include all buffer tube fan out kits as required.
13. Product Specification:
 - a. Panduit Rack Mount Enclosure #FRME1U, #FRME2U
 - b. Panduit Adapter plate 50µm Aqua LC #FAP12WAQLCZ
 - c. Panduit Adapter plate Single mode Blue LC #FAP12WBULCZ
 - d. Panduit Adapter plate blank #FAPB

2.9 FIBER OPTIC CONNECTORS

- A. Fiber Optic Connectors: Provide a field installable single mode or multimode type connectors to terminate fiber optic cables from cable-to-cable, cable-to-equipment, or equipment-to-equipment, and to make jumpers.
 1. The connector must:
 - a. Be pre-polished and field installable.
 - b. Ferrule shall be made of zirconia ceramic.
 - c. Be capable of mounting on either 250 um or 900 um buffered fiber.
 - d. Single mode shall be rated OS2, and multimode shall be rated OM4.

- e. Average connector insertion loss: Multimode 0.3dB, Single mode 0.3dB.
 - f. Maximum insertion loss: Multimode 0.5dB. Single mode 0.5dB.
 - g. Be available in LC and SC style for single-mode and multimode.
 - h. Have a locking feature to the coupler and assure non-optical disconnect.
2. Product Specification:
- a. Single mode Blue LC, Panduit #FLCSSCBUY

2.10 COPPER CABLING

A. Outside Plant Multipair Copper Cables

- 1. All outside plant multipair copper cables shall support analog voice circuits (fire alarm, intrusion alarm, elevator phone, etcetera) and building energy management systems.
- 2. All copper cable placed in the outside environment shall be 24 AWG, solid annealed copper, twisted pair, and multi-conductor. Refer to section 1.12.A of this document for additional requirements.
- 3. Quantity of twisted pairs shall be 25 pairs.
- 4. The outside plant cable shall have PET Tape core wrap.
- 5. The outside plant cable shall have a low smoke zero halogen, Indoor/Outdoor grade jacket.
- 6. All outside plant cable shall be installed in conduit. Direct burying of cable is prohibited.
- 7. Multi-pair voice grade copper cables installed in underground conduit shall be minimum Category-5E rated.
- 8. Product Specification: Superior Essex #51-499-EL

B. Indoor Multipair Copper (Riser) Cables: In multi-story buildings, shielded or unshielded 24 AWG multi-pair copper cables shall be used as vertical riser cables between floors. The inner-building cable shall support analog voice circuits (fire alarm, intrusion alarm, elevator phone, etc.) and building energy management systems. The bending radius and pulling strength requirements of all backbone cables shall be observed during handling and installation. The multi-pair copper cables shall be in plenum or riser rated form and placed in conduit as required by code, or as noted on the bid documents/plan drawings.

- 1. Shielded: The shielded cable, 25 pair or more, shall consist of solid-copper conductors insulated with expanded polyethylene covered by a PVC skin, be conformance tested to meet ANSI/TIA/EIA 568-C for Category 5E cables, be UL and Listed as CMR. The core shall be overlaid with a corrugated aluminum

sheath, which is adhesively bonded to an outer jacket of PVC plastic to form an ALVYN sheath.

- a. The cable shall be available in 25, 50, 100 through 1800 pair counts.
 - b. Product Specification: BerkTek or Superior Essex, ARMM type cable.
2. Non-shielded: The non-shielded non-plenum cable shall consist of 24-AWG solid-copper conductors insulated with color coded PVC, UL Verified to ANSI/TIA/EIA 568-C for Category 5E. The non-shielded cable shall be available in 25, 50, 75 and 100 pair.
 - a. Product Specification: Superior Essex, ARMM type cable, or equal.

2.11 INDOOR MULTI-PAIR RISER CABLE TERMINATIONS

- A. The multipair riser cable wiring block shall be 66M-split-type and support Category 5E and 6 applications and facilitate cross connection and interconnection using either cross connect wire or the appropriate category patch cords. The wiring blocks shall support analog voice circuits (fire alarm, intrusion alarm, elevator phone, etcetera) and building energy management circuits.
 1. The wiring blocks shall be fire retardant, molded plastic 4 columns of metal contacts. The blocks will have 100 contacts which are divided into 50 pairs. This will allow the termination of 25 individual cable pairs on the left and right side of the wiring block, for a total of 50 cable pairs per block.
 2. The wiring blocks shall have a series of fanning strips shall be located on each side of the block for dressing the cable pairs terminated on the adjacent contacts.
 3. Plastic hinged covers shall be provided on each block and shall not interfere with running, tracing, or removing jumper wire. Labels shall be color-coded, and machine labeled/numbered according to Owner's requirements.
 4. The wiring blocks shall be able to mount directly on wall surfaces utilizing a standoff bracket, either with or without metal backboards. The standoff bracket shall be 10" high by 3.40" wide by 1.50" deep.
 5. The wiring blocks shall be able to accommodate over 500 repeated insertions without incurring permanent deformation and it shall pass the reliability test of no more than one contact failure in 10,000 connections.
 6. Product Specification: Leviton #40066-M25, or equal by Hubbell, with 89B bracket Leviton #40089-00D.
- B. MPOE/MDF/IDF Rooms, or as otherwise indicated on drawings, shall be equipped with 66M-type termination blocks for termination of analog station cables. All blocks shall be securely fastened to the room backboards or equipment racks – refer to bid documents/plan drawings. Provide all required D-rings or other approved cable

guides as required to provide a neat installation. All cables shall terminate in numerical sequence. Refer to subsection above for description of termination blocks.

2.12 PROTECTORS

- A. All outside plant underground backbone multi-pair copper cables shall be provided with transient voltage protection between each building with an building entrance-cable protector panel(s). All building-to-building multipair copper cables shall be routed through this protector(s). The protector(s) shall be connected with a #6 AWG copper bonding conductor between the protector's ground lug and the MDF/IDF telecommunications ground busbar (TMGB/TBG).
- B. Plug in Surge Protection Modules shall be provided for each pair terminated on the protector chassis. Protector module shall be solid-state type unless otherwise noted.
 - 1. 240VDC/300VDC solid-state protector modules shall provide transient and power fault protection for standard telephone line applications. The modules shall be fast acting, self-resetting current limiters to protect against sneak current type faults. These modules shall be UL Listed with integrated test points and Black in color.
 - 2. 30VDC/75VDC solid-state protector modules shall provide transient and power fault protection for digital and data line applications. The modules shall be fast acting, self-resetting current limiters to protect against sneak current type faults. These modules shall be UL Listed with integrated test points and Red in color.
 - 3. In the event that protector modules are not called out in the drawings, Contractor shall include all costs in base bid to provide the 75v solid-state modules w/sneak current protection. Confirm module color with Owner's Engineer prior to ordering. In all cases, the Contractor is responsible to coordinate appropriate module with District prior to ordering material.
- C. Product Specification: Circa, Emerson or Marconi.

2.13 GROUNDING SYSTEM AND CONDUCTORS

- A. The Contractor shall utilize a Telecommunications Bonding Backbone (TBB) as provided by the Electrical Contractor. The Contractor shall terminate TBB cable(s) on Contractor-provided ground bus bars located at each MDF/IDF Room, or as otherwise indicated on the drawings. Ground bus bars shall be ANSI-J-STD-607-A compliant and UL Listed. MDF telecom main ground bus bar (TMGB) shall be Chatsworth #40153-020. IDF telecom ground bus bars (TGB) shall be Chatsworth #40153-012, or as noted on the drawings. Wall mounted cabinets require a horizontal rack bus bar (Chatsworth #10610-XXX) (equal by Harger). All communication system bonding and grounding shall be in accordance with the ANSI-J-STD-607-A (current edition), the NEC/CEC, and NFPA.
- B. Horizontal cables shall be grounded in compliance with ANSI/NFPA 70 and local requirements and practices.

- C. Horizontal equipment including cross connect frames, patch panels, cable trays, equipment racks, ladder trays, conduits, active telecommunication equipment, test apparatus and equipment shall be bonded to the ground bus bars utilizing a #6-AWG solid copper green insulated conductor and 2-hole crimp type grounding lugs. All connections shall be bare metal to bare metal using appropriate antioxidant compound. Burndy mechanical-type grounding lugs and terminals are prohibited. Minimize the length and number of bends of the grounding conductors to the busbar. Attachment to every rack and cabinet shall be made by one of the following methods:
 - 1. Wall mounted IDF cabinets- Attach ground conductor's 2-hole compression lug to the rear rail's top holes of the rack, or front rail's top hole of the cabinet, using either two (2) tri-lobular thread-forming screws (not self-tapping or sheet metal screws) or by using two (2) standard bolts with two (2) "Type B" internal-external tooth lock washers per bolt. If thread-forming screws are not used, remove paint at the connection point and use an approved anti-oxidant prior to attaching the ground conductor.
 - 2. Floor Mounted Cabinet/Racks - Install a dedicated copper horizontal ground busbar strip at the top of the rear rail of each rack and cabinet. Attach ground conductor's 2-hole compression lug to this ground strip using either tri-lobular thread-forming screws (not self-tapping or sheet metal screws) or by using two (2) standard bolts with two (2) "Type B" internal-external tooth lock washers per bolt.
- D. The Contractor shall be responsible for providing an approved ground at all newly installed distribution frames, and/or insuring proper bonding to any existing facilities. The Contractor shall also be responsible for ensuring ground continuity by properly bonding all appropriate cabling, cable sheaths, circuit protectors, closures, cabinets, service boxes, and framework.
- E. Contractor shall label both ends of each grounding conductor as close as practical to the point of termination in a readable position. Ground tag must indicate the location of both ends of the ground conductor (e.g., Rack#1 to TMGB) and tag must include the warning "If this connector or cable is loose or must be removed, please call the Owner's Telecommunications Manager at xxx-xxx-xxxx (Contractor shall include the proper phone number on this label)".

2.14 OPEN EQUIPMENT RACKS

- A. When shown on drawings, communication closets shall be equipped with floor mounted, open equipment racks provided by the Contractor to house shelves, patch panels, power strips, LAN electronics, UPS, etcetera. The racks shall be made of aluminum and include mounting hardware for mounting specified termination equipment to the frame.
- B. Open 2-post rack dimensions shall be 7' H x 19" W x 3" D.
- C. Racks shall be UL-Listed, and rated for heavy-duty, high-capacity installations. The 2-post racks shall be rated up to 1500 pounds, and 4-post racks rated to 2000 pounds.

- D. Equipment racks and rack mount accessories shall be Black in color.
- E. Floor mounted open racks shall be secured from the base to the structural floor to prevent movement and secured to ladder tray sections installed above. Contractor shall provide and install a minimum of four (4) fasteners/anchors per floor mounted rack. Fasteners installed to the structural floor shall be torqued to the "fastener manufacturer's" recommendation.
- F. Racks mounted on raised floors shall be seismically braced to the structural floor below the raised floor to the satisfaction of DSA, and all local, state, and federal requirements.
- G. Floor-mounted open racks shall be secured to the overhead ladder runway.
- H. All racks shall be individually grounded to the dedicated telecommunications ground busbar (TMGB, TGB) within the equipment room using a 2-hole compression ground lugs and #6 AWG stranded green jacketed conductor. This ground conductor shall be run as straight as possible, with the length kept as short as possible. Ground wire shall be neatly secured to the rack and ladder runway. "Daisy-chaining" a ground conductor between racks or to other components is not allowed.
- I. All racks shall be equipped with vertical cable managers on each side, and horizontal cable managers. Refer to cable manager section in this document for more information.
- J. Product Specification: B-Line 2-post rack #SB556084XU, or Chatsworth, 2-post rack #48353-703, 4-post rack #15218-703

2.15 EQUIPMENT CABINETS

- A. When shown on drawings, cabinets shall be provided by the Contractor to house shelves, patch panels, power strips, LAN electronics, UPS, etcetera. The cabinets shall be UL Listed and include mounting hardware for mounting specified termination equipment to the frame. In addition, the mounting hardware must provide vertical and horizontal wire managers for patch cords and equipment cords.
- B. Wall mount cabinet dimensions shall be 24"H x 24"W x 30"D, and 48" H x 24" W x 30" D.
- C. Wall mount Low Profile cabinets shall be 42"H x 24"W x 10"D.
- D. Contractor shall provide vertical and horizontal wire managers for patch and equipment cords.
- E. Cabinets and accessories shall be Black in color. Low profile cabinets shall be Gray in color.
- F. Wall mounted cabinets, when indicated on the plan drawings, shall be secured to plywood backboard at locations indicated on the plan drawings. Contractor shall provide and install fasteners and anchors that are designed and rated for the

determined mounting surface and building construction type. Contractor shall provide and install fasteners and anchors that are designed and rated for the combined weight of the equipment support cabinet and its contents. Contractor shall be responsible for determining correct cabinet mounting and anchoring methods that will safely support the combined weight of the cabinet and its contents. Contractor shall install cabinet in such a manner that a minimum of four (4) fasteners and/or anchors are attached directly into wall framing studs, or if applicable, masonry or concrete wall. Anchoring methods shall comply with DSA requirements and all local, state, and federal safety codes.

- G. Cabinets shall be configured per the District's Project Manager's direction.
- H. All floor and wall mounted cabinets shall be individually grounded to the isolated ground busbar (TMGB, TGB) within the equipment room using a 2-hole compression ground lug and #6 jacketed green cable. Wall mounted cabinets require a horizontal rack bus bar (Chatsworth #10610-XXX, equal by Harger) installed at the top position of the front rails. Attach ground lug to this horizontal busbar. Ground wire shall be run as straight as possible, with the length kept as short as possible. Ground wire shall be neatly bundled and secured to the cabinet and ladder tray. Daisy chaining of ground wire between cabinets or to other components is not allowed. Wall mounted Low Profile Cabinets shall be grounded to the nearest electrical panel's ground busbar using a 2-hole compression lug and #6 jacketed green cable.
- I. Cabinets mounted on raised floors shall be seismically braced to the structural floor below the raised floor to the satisfaction of DSA and all local, state, and federal requirements.
- J. Cabinets shall come equipped with a locking Plexiglas front door.
- K. Product Specification: Chatsworth Cube-IT #12419-724, #12419-748, Hubbell Low Profile #RE4X

2.16 HORIZONTAL AND VERTICAL CABLE MANAGERS

- A. Horizontal cable managers shall be available in 1RU and 2RU sizes and fit in 19"-wide racks and cabinets. Horizontal managers shall be single-sided and come equipped with hinged, removable covers, unless otherwise noted.
- B. Vertical managers shall be 7-foot high, 6-inch wide, double sided, with full length hinged door on the front and open cable rings on the rear. Provide 10-inch wide instead of 6-inch-wide vertical managers when specifically noted on the plan drawings.
- C. In each MDF and IDF rack, provide one (1) 1RU horizontal cable manager below each rack mounted fiber enclosure, and below each 24-port patch panel, unless otherwise noted. Provide one (1) 2RU horizontal cable manager below each 48-port patch panel, unless otherwise noted.
- D. Product Specification: Chatsworth Vertical Manager #40095-703, Chatsworth 1RU horizontal manager #30139-719, Chatsworth 2RU horizontal manager #30130-719.

2.17 BACKBOARDS

- A. Where indicated on plan drawings, provide new plywood terminal backboards. Use Douglas Fir plywood, A/C grade, finished A-side facing out, with prime coat painted on all surfaces (front, back and sides), and a finish coat of white enamel paint on the front. On each plywood sheet leave one (1) Fire Marshal Stamp unpainted for inspection. Unless otherwise indicated, use 8'-0" high x 3/4" thick plywood x length as shown on the plan drawings.

2.18 UNSPECIFIED EQUIPMENT AND MATERIAL

- A. Any item of equipment or material not specifically addressed on the drawings or in this document and required to provide a complete and functional SCS installation shall be provided in a level of quality consistent with other specified items.

2.19 FIRE RATED PATHWAY

- A. The firewall through-penetration shall be a manufactured, UL Classified, firestop device/ system designed to allow cables to penetrate fire-rated walls with a built-in fire sealing system that automatically adjusts to the amount of cables installed.
- B. The firestopping device shall be capable of installation in new construction or retrofit in existing structures.
- C. The device shall be UL Tested and Classified in accordance with ASTM E814 (UL 1479) and with ratings up to and including 2 hours.
- D. Contractor shall be responsible to provide firestopping devices for all SCS cables that penetrate a fire-rated assembly (wall, floor, ceiling).
- E. Manufacturer: Specified Technologies Inc., EZ-Path (#EZDP33FW) or equal by Wiremold.

PART 3 – EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. The wiring of the system shall be executed in accordance with the drawings and the equipment manufacturer's wiring diagrams. Should any variations in these requirements occur, the Contractor shall notify the District's Project Manager before making any changes. It shall be the responsibility of the manufacturer-authorized distributor of the approved equipment to install the equipment and guarantee the system to operate as per plans and specifications.
- B. Furnish all conductors, equipment plugs, terminal strips, etcetera, and labor to install a complete and operable system.
- C. The cables within the rack or cabinets shall be numbered for identification using machine generated labels wrapped around the cable jacket within 6 inches of termination point. Refer to Labeling Requirements section of this document for additional requirements. Handwritten labels are prohibited.

- D. Splicing of any cable is prohibited.
- E. The labor employed by the Contractor shall be regularly employed in the installation and repair of communication systems and shall be acceptable to the District's Project Manager to engage in the installation and service of this system.
- F. The system must meet all local and other prevailing codes.
- G. All cabling installations shall be performed by qualified and manufacturer-trained technicians.
- H. Cable lubricants (e.g., Polywater) shall be used to reduce the cable pull tension stated by the cable manufacturer during cable installation in conduits and innerduct. SCS Contractor shall verify the acceptability of the lubricant to be used with the cable manufacturer, prior to using such a lubricant. Lubricants that harden after installation are not allowed. Submit all proposed lubricants for approval PRIOR to use on low voltage, A/V, coax, fiber, and data cable installation. Cable lubricants shall be allowed to dry a minimum of 15 days before performing cable certification tests.
- I. Indoor rated cables may be run exposed above accessible ceilings, provided the cabling is supported independent of other utilities such as conduits, pipes, and the ceiling support systems. The Contractor shall include all costs in base bid for any additional supports/seismic bracing required by the Local Authority having Jurisdiction. The cables shall not be laid directly on the ceiling panels.
- J. The cable jacket composition must meet local and all other prevailing fire and safety codes.
- K. All firewalls penetrated by structured cabling shall be sealed by use of a non-permanent fire blanket or other method in compliance with the current edition of NFPA and the CEC or other prevailing code and must be a system listed by UL. The SCS Contractor must not use concrete or other non-removable substance for fire stopping on cable trays, wireways or conduits. Contractors who use this method will be required to replace all cables affected and provide the original specified access to each effected area. This requirement also applies to maintaining fire ratings of all floors penetrated by conduits or devices designated for use by voice and data cabling.
- L. All equipment racks and cabinets shall be bolted to the structural floor by the SCS Contractor in the location shown on drawings. Wall mounted relay rack and wall mounted cabinet kits shall be fastened to structural studs, not drywall or backboard only.
- M. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the Contractor before final acceptance at no cost to the Owner.
- N. The cable manufacturer's minimum bend radius and maximum pulling tension shall not be exceeded.

- O. Cable raceways, when required, shall not be filled greater than the NEC maximum fill for the particular raceway type. At no point shall any conduit fill exceed 40 percent.
- P. SCS Contractor shall provide and install all conduit sleeve penetrations through all sound and fire rated assemblies (wall, floor, ceiling) whether or not the sleeves are shown on the plan drawings. Include all costs in base bid. All low voltage cables that penetrate a wall, floor or ceiling shall be enclosed in a conduit sleeve. Penetrations through fire-rated assemblies shall be properly fire stopped to the original fire rating of the assembly by the Contractor.
- Q. Roof penetrations are prohibited, unless specifically noted on the plan drawings. No conduit shall be installed on roofs or route horizontally on exterior walls.

3.2 SPECIFIC SYSTEM INSTALLATION REQUIREMENTS

- A. All communications cabling used throughout this project shall comply with the requirements as outlined in the NEC Articles 725, 760, 770, and 800 (or related CEC Articles), and the appropriate local codes. All copper cabling shall bear UL listed type CMP (Plenum Rated) and/or CM/G (General Purpose) and/or CMR (Riser Rated). All fiber optic cabling shall bear OFNP (Plenum Rated) and/or OFNR (Riser Rated) and/or OFN/G (General Purpose). The Contractor is responsible for installing appropriately rated cable for the environment in which it is installed.
- B. Cable Pathways:
 - 1. In suspended ceilings and accessible ceiling areas where duct, cable trays or conduit are not available, the Contractor shall bundle cable, in bundles of 48 or less. Cable bundles shall be supported via "J" hooks attached to the existing building structure and framework at a maximum of five (5) foot intervals. The SCS Contractor shall adhere to the manufacturers' requirements for bending radius and pulling tension of all cables.
 - 2. Cables or J-hooks shall not be attached to lift-out ceiling grid supports or laid directly on the ceiling grid.
 - 3. Cables or J-hooks shall not be attached to or supported by fire sprinkler heads, HVAC ducts, or delivery systems, or any environmental sensor located in the ceiling air space.
 - 4. Where additional conduit(s)/sleeve(s) are required, but not provided by the electrical Contractor, the cabling Contractor shall be responsible to provide such conduit(s)/sleeve(s). Conduit(s) and sleeve(s) shall be of suitable material, sized, installed, fire-stopped, and grounded as may be required by the NEC, ANSI/TIA/EIA standards and all other applicable codes and standards. Any conduit(s) and sleeve(s) added by the Contractor shall be approved by the District's Project Manager prior to rough-in. Conduit sleeves 10 feet in length or less do not require grounding.
 - 5. All J-hooks shall be rated and designed for Category 6 and 6A cabling.

- C. Sealing of openings between floors, into or through rated fire and smoke walls, existing or created by the Contractor for placement of new or removal of old cable into or through shall be the responsibility of the SCS Contractor. Sealing material (Approved UL listed system) and application of this material shall be accomplished in such a manner that is acceptable to the local fire and building authorities having jurisdiction over this work. Creation of such openings as are necessary for cable passage between locations as shown on the drawings shall be the responsibility of the Contractor's work. Any openings created by or for the SCS Contractor and left unused shall also be sealed as part of this work.
1. Fire stopping work shall be performed by a single Contractor to maintain consistency and accountability on the project.
 2. The Contractor shall install penetration firestop seal materials in accordance with design requirements, and manufacturer's instructions.
 3. The Contractor's installer shall be certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements.
 4. All installed through penetration firestops shall be identified via label, or stencil. Label shall state that the fill material around the penetrating item is a firestop, and that it shall not be disturbed unless by an authorized Contractor. The label shall include the firestop brand name, and the classified system number for which it was installed.
 - a. Sample Label:

MANUFACTURER'S NAME:
ATTENTION
Fire Rated Assembly
For Any Changes To This System, Please Refer To UL System Listed
Below
PRODUCT:
HOUR RATING:
UL SYSTEM:
INSTALLATION DATE:
INSTALLED BY: (Contractor's Company name)
CONTRACTOR LICENSE NUMBER:
BUSINESS PHONE:
EMAIL ADDRESS:
- D. The Contractor shall be responsible for damage to any surfaces or work disrupted because of his work. Repair of surfaces, including painting, shall be included as necessary.
- E. Cable bundles within the MDF/IDF shall be dressed into bundles of no more than twenty-four (24) cables. Maintain each bundle with half inch-wide hook and loop strips spaced every twelve (12) inches maximum.

- F. The Contractor shall install all patch cords per direction of the District's project manager in a neat and systematic fashion. Prior to installing all patch cords, the Contractor shall install patch cords in a single rack to demonstrate work practices to the District's project manager. Only after any corrections/modification to the installation as directed by the District's project manager, may the Contractor continue installing the patch cords in the remaining racks.
- G. Each equipment cabinet and rack located in the MDF/IDF rooms require their own dedicated grounding connection to the grounding infrastructure. Grounding infrastructure shall consist of a dedicated #6 AWG (min.) green conductor from every rack/cabinet back to the TMGB/TGB. Wall mounted cabinets shall be grounded to the nearest electrical panel ground busbar by the electrical Contractor using a #6 AWG green conductor. All ground conductor attachments to the TMGB/TGB shall utilize 2-hole compression lugs. See Section 2.13 Grounding System and Conductors of this document for more information.
- H. In raised-floor environments, the ground conductor shall attach to the lowest holes on the front rail of each rack/cabinet.
- I. Rack/cabinet mounted equipment shall be grounded via the equipment chassis, in accordance with manufacturer's instructions. The equipment chassis shall be bonded to the rack/cabinet using one of the following methods:
 - 1. If the equipment has a separate grounding hole or stud, use a #10-AWG ground wire from the chassis ground hole/stud to the rack grounding bus.
 - 2. If the manufacturer suggests grounding via the chassis mounting flanges, use tri-lobular thread-forming screws (not self-tapping or sheet metal screws) to attach the equipment to the rack/cabinet rails. If the equipment mounting flanges are painted, remove the paint and apply an anti-oxidant, or use tri-lobular thread-forming screws and two (2) "Type B" internal-external tooth lock washers to safely ground equipment to the rack.
- J. Bonding of ladder tray sections- Attach bonding straps to each ladder tray section by utilizing either two (2) tri-lobular thread-forming screws (not self-tapping or sheet metal screws) or by using two (2) standard bolts with two (2) "Type B" internal-external tooth lock washers per bolt. If thread-forming screws are not used, remove paint at each connection point and use an approved anti-oxidant prior to attaching the bonding strap.
- K. All installation shall be done in conformance with TIA/EIA 568-C standards, BICSI TDMM guidelines and manufacturer's installation guidelines. The Contractor shall ensure that the maximum pulling tensions of the specified distribution cables are not exceeded and cable bends maintain the proper radius during the placement of the facilities. Failure to follow the appropriate guidelines will require the Contractor to provide, in a timely fashion, any additional material and labor necessary to properly rectify the situation to the satisfaction and written approval of the District's Project Manager. This shall also apply to all damages sustained to the cables by the Contractor during the implementation.

1. **Bonding and Grounding:** All cable sheaths and splice cases shall be grounded to a Telecommunications Ground Bus. All grounding must be in accordance with the NEC, CEC, NFPA, ANSI-J-STD-607-B and all local codes and practices. The Electrical Contractor shall be responsible for providing a properly sized grounding conductor from the main electrical ground to the telecommunications ground bus in each MDF/IDF room. The SCS Contractor shall be responsible to provide the telecommunications busbar (TMGB, TGB), attach the Electrical Contractor-provided ground conductor, and bond all required equipment and components within each MDF/IDF to the busbar.
2. **Power Separation:** The Contractor shall not place any distribution cabling alongside power lines, or share the same conduit, channel, or sleeve with electrical apparatus. Maintain a minimum of 12-inch separation from light fixtures.
3. **Miscellaneous Equipment:** The Contractor shall provide any necessary screws, anchors, clamps, hook & loop ties, distribution rings, wire molding (MDF & IDF locations), miscellaneous grounding and support hardware, etc., necessary to facilitate the installation of the System.
4. **Special Equipment and Tools:** It shall be the responsibility of the Contractor to furnish any special installation equipment or tools necessary to properly complete the System. This may include, but is not limited to, tools for terminating cables, testing, and splicing equipment for copper/fiber cables, communication devices, jack stands for cable reels, or cable winches.
5. **Labeling:** The Contractor shall be responsible for printed labels for all pull boxes, conduits, cables, protectors, racks, cabinets, patch panels, connector panels, cords, distribution frames, and outlet locations, according to the specifications. Handwritten labels are prohibited. See LABELING REQUIREMENTS Section 3.9 of this document for more information.
6. **Cable Storage:** The Contractor shall not roll or store cable reels without an appropriate underlay and the prior written approval of Owner's Project Manager.
7. **Cable Records:** The Contractor shall maintain conductor polarity (tip and ring) identification at the main equipment room (switch room), risers, and station connecting blocks in accordance with industry practices, but only in locations authorized by the Owner's Project Manager. Contractor to provide spread sheet for all outdoor backbone and indoor riser backbone cables tested.

3.3 STRUCTURED CABLING GENERAL INSTALLATION DESCRIPTION

- A. The structured cabling system shall consist of the following subsystems:
 1. Work Area Subsystem
 2. Horizontal Subsystem
 3. Administration Subsystem

4. Backbone Subsystem
5. Equipment Subsystem
- B. Work Area Subsystem: The Work Area Subsystem provides the connection between the telecommunications outlet (TO) and the station equipment in the work area. It consists of patch cords, adapters, and other transmission electronics.
 1. Contractor shall supply the wiring or patch cords that connect terminal devices to telecommunications outlets. This includes mounting cords and connectors.
- C. Horizontal Subsystem: The Horizontal Subsystem provides connections from the horizontal cross connect to the telecommunications outlets in the work areas. It consists of the horizontal transmission media (copper, fiber, etc.), the associated connecting hardware terminating this media and outlets in the work area. Each floor of a building is served by its own Horizontal Subsystem(s) unless otherwise noted on the plan drawings.
 1. Horizontal Cabling
 - a. Contractor shall supply horizontal cables to connect each telecommunications outlet to the backbone subsystem as shown on the drawings.
 - b. Unless otherwise noted on the floor plans or within this document, the type of horizontal cables used for each work location shall be 4-pair unshielded twisted pair (UTP).
 - c. The 4-pair UTP cables shall be run using a star topology format from the administration subsystem to every individual telecommunications outlet. All cable routes, other than those dictated on the drawings, are to be approved by District's Project Manager prior to installation.
 - d. The length of each individual run of horizontal cable from the administration subsystem to the telecommunications outlet shall not exceed 295-ft (90 m).
 - e. Contractor shall observe the bending radius and pulling strength requirements of the 4-pair UTP cable during handling and installation.
 - f. Each run of cable between the termination block and the telecommunications outlet shall be continuous without any joints or splices.
 - g. All station cable shall be placed in the interior of walls unless otherwise noted in the bid documents/plan drawings.
 - h. In the event Contractor is required to remove ceiling tiles, such Work shall not break or disturb the ceiling grid. Removal of the ceiling grid must be coordinated with the Owner's Project Manager. All insulation shall be replaced in its original location. Contractor shall be responsible

- to replace any ceiling tiles that they damage during the course of their work, at no additional cost to the District.
- i. Avoid electromagnetic interference (EMI) by maintaining adequate physical separation between telecommunications cabling and possible sources such as, but not limited to, electric motors, electric erasers, electric pencil sharpeners, transformers, fluorescent lighting that share distribution space with telecommunications cabling, copiers that share work area space with line cords and terminals, large fax machines and power cords that supports such equipment. Minimum separation shall be six (6) inches.
 - j. Contractor shall provide District's Project Manager with detailed cable run diagrams for cable runs within raised floors (if shown on plans) detailing exact locations of cable for review and written approval by Owner's Project Manager.
 - k. Conduit runs installed above grade by the Contractor should not exceed 100 feet or contain more than two 90 degree bends without utilizing appropriately sized pull box. Pull boxes are not to be used in lieu of a bend.
 - l. Station cables and riser cables installed within ceiling spaces shall be routed through these spaces at right angles to electrical power circuits.
 - m. Each station cable shall have 1 meter of service slack configured in an "S" shape via J-hooks at rack or wall field end and 1 foot of service loop at station outlet end. Service slack shall be located within 15' of the MDF/IDF as required to maintain a neat and "workmanship like" installation.
- D. Administration Subsystem: The Administration Subsystem links all the subsystems together. It consists of labeling hardware for providing circuit identification and patch cords or jumper wire used for creating circuit connections at the cross connects. All wall field layouts must be approved by Owner's Project Manager prior to rough-in and installation.
- 1. Separate termination fields shall be created for voice/data, wireless access points, paging, surveillance cameras, clocks, and building energy management system applications.
 - 2. Termination blocks that require rotation after connection of horizontal/vertical wiring will not be allowed.
 - 3. Contractor shall supply cross-connect wire, patch cords and fiber patch cords for cross-connection and inter-connection of termination blocks and lightguide interconnection units.
- E. Backbone Subsystem:

1. The main cable route between two or more buildings is called the Backbone Subsystem. It links the main distribution frame (MDF) in the equipment room to each intermediate distribution frame (IDF). It consists of the backbone transmission media between these locations and the associated connecting hardware terminating this media. It is normally installed in a star topology, with first-level backbone cables beginning at the main cross connect. If needed, second-level backbone cables begin at intermediate cross connects.
 2. The backbone subsystem shall include vertical runs (riser) of in-building cable between floors of a multi-story building, if applicable.
 3. All backbone fiber optic cable(s) will be run in innerduct and terminated in the MDF/IDF Rooms, or as otherwise indicated on the plan drawings, with connectors, type as specified elsewhere, in rack mounted or wall mounted fiber patch panels equipped with sufficient panels, couplers and jumper storage shelves to terminate and secure all fibers. All innerduct (Carlson or equal) shall be corrugated and a minimum of 3/4" in diameter unless otherwise indicated on plans. Innerduct shall be plenum, riser or general rated as required by the environment in which it is to be installed. Innerduct capacity shall not exceed 40 percent fill.
 4. All backbone multipair copper cable(s) will be terminated in the MDF/MPOE/IDF rooms, or as otherwise indicated on the plan drawings. Backbone multipair cable shall be terminated on building entrance fused protectors as specified elsewhere in this document. The minimum pair count for multipair copper cable between buildings shall be 25-pairs. Refer to bid documents/plan drawings for any additional required pairs.
 5. In multi-story buildings, Contractor shall supply multi-pair copper cables and optical cables as the riser cables between floors. Reference this document and plan drawings for quantities. Contractor shall observe the bending radius and pulling strength requirements of all backbone cables during handling and installation.
- F. Equipment Room Subsystem: The Equipment Subsystem consists of shared (common) electronic communications equipment in the equipment room or telecommunications closet and the transmission media required to terminate this equipment on distribution hardware.

3.4 DAMAGES

- A. The Contractor will be held responsible for all damages to portions of the building caused by it, its employees, or sub-Contractors; including but not limited to:
1. Damage to any portion of the building caused by the movement of tools, materials, or equipment.
 2. Damage to any component of the construction of spaces.
 3. Damage to the electrical distribution system.

4. Damage to the electrical, mechanical and/or life safety or other systems caused by inappropriate operation or connections made by the Contractor or other actions of Contractor.
5. Damage to the materials, tools and/or equipment of the Owner, its consultants, agents, and tenants.

3.5 PENETRATIONS OF WALLS FLOORS AND CEILINGS

- A. Unless specifically shown on the drawings, the Contractor shall make no penetration of floors, walls, or ceiling without the prior written approval of the Owner's Project Manager.
- B. Any penetrations through acoustical walls or other walls for cable pathways/cables shall be sealed by the Contractor in compliance with applicable code requirements and as directed by Owner's Project Manager.
- C. Any penetrations through fire-rated walls for cable pathways/cables shall be sealed by the Contractor as required by code and as directed by Owner's Project Manager. The Contractor shall be required to work together with the General Contractor and the Electrical Contractor to coordinate and develop all fire stopping methods prior to any cable installation. The Contractor shall also, prior to the commencement of on-site activities, submit to Owner's Project Manager, details of any special systems to be used.
- D. Roof penetrations are prohibited. No conduit shall be installed on roofs or route horizontally on exterior walls.

3.6 TESTING AND WARRANTY

- A. Structured Cabling System
 1. The Contractor shall provide competent, test equipment manufacturer-trained engineers and/or technicians, authorized by the manufacturer of the cabling system, to technically supervise and participate during all tests for the systems.
 2. The Contractor shall test and certify the cabling system to minimum standards as set forth in the TIA/EIA-568-C specifications for 100BaseTX Ethernet and for Category 6 cable, token ring, and 1000baseT signals.
 3. All cables and termination hardware shall be 100% tested for defects in installation and to verify cable performance under installed conditions. All conductors of each installed cable shall be verified usable by the Contractor before system acceptance. Any defect in the cable system installation including but not limited to cable, connectors, feed-through couplers, patch panels, splices, and connector blocks shall be repaired or replaced to ensure 100% useable conductors in all cables installed.
 4. Each cable shall be tested for continuity on all pairs and/or conductors. Twisted-pair voice cables shall be tested for length, continuity, pair reversals,

opens, shorts, transpositions, presence of AC and DC voltages and opens. Twisted-pair horizontal cables shall be tested per the above requirements, plus tests that indicate installed cable performance. Category-6 and category-6A cables shall be tested using a TIA-568-C.2-1 Category 6A Level III/IEC 61935 Level III or better, ETL certified cable tester/analyzer.

5. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests.
6. The test shall be recorded as pass/fail as indicated by the test set in accordance with the manufacturers recommended procedures and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested before final acceptance.
7. Each installed cable shall be tested for installed length using a Time Domain Reflectometer (TDR) type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the TIA-568-C Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number.
8. Multi-pair cables, record the following tests on every cable pair in each multipair cable using a TDR type device: record the shortest pair length, continuity, pair reversals, shorts, opens, transpositions, presence of AC and DC voltage.
9. Enhanced Category 6 and 6A data cable shall be performance verified using an automated test set. This test set shall be capable of testing for the continuity and length parameters defined above, and provide results for the following tests:
 - a. Attenuation (Insertion Loss).
 - b. Return Loss (RL).
 - c. Near End Crosstalk (NEXT) – measured at both ends of each cable pair.
 - d. Attenuation to Crosstalk Ratio (ACR).
 - e. Power Sum Near End Crosstalk (PSNEXT).
 - f. Power Sum Attenuation to Crosstalk Ratio (PSACR).
 - g. Far End Crosstalk (FEXT).
 - h. Equal Level Far End Crosstalk (ELFEXT).
 - i. Power Sum Equal Level Far End Crosstalk (PSELFEXT).

10. Test results shall be automatically evaluated by the equipment, using the most up-to-date criteria from the ANSI/TIA/EIA Standard, and the result shown as pass/fail. Test results shall be printed directly from the test unit or from a download file using an application from the test equipment manufacturer. The printed test results shall include all tests performed, the expected test result, and the actual test result achieved.
11. Optical Fiber Cable Testing: All fiber testing shall be performed on all fibers in the completed end to end system by test equipment manufacturer-trained engineers and/or technicians. There shall be no splices unless clearly defined in Section 3 of this specification or on the plan drawings. Testing shall consist of a bi-directional end to end OTDR trace performed per ANSI/TIA/EIA 455-61 & ANSI/TIA/EIA 526 and a bi-directional end to end power meter test performed per ANSI/TIA/EIA 455-53A. The system loss measurements shall be provided at 850 and 1300 nanometers for multimode fibers and 1310 and 1550 for single mode fibers.
 - a. Pre-installation cable testing: The Contractor shall test all fiber optic cable prior to the installation of the cable. The Contractor shall assume all liability for the replacement of the cable should it be found defective during the warranty period.
 - b. Loss Budget: Fiber links shall have a maximum loss of: (allowable cable loss per km) x (km of fiber in link) + (.4dB) x (number of connectors) = maximum allowable loss.
 - c. Any link not meeting the requirements of the standard shall be brought into compliance by the Contractor, at no additional charge to District.
12. The SCS Contractor shall provide test documentation to the District's Project manager in a three-ring binder(s) and in CD format within three weeks after the completion of a specific project. The binder(s) shall be clearly marked on the outside front cover and spine with the words "Test Results", the project name, and the date of completion (month and year). The binder shall be divided by test type. A paper copy of the test results shall be provided that lists all the links that have been tested, and include link name, overall pass/fail evaluation, date and time of test, cable type and NVP value. Detailed test results shall be provided for each link tested and shall include length, propagation delay, delay skew, insertion loss, return loss, NEXT, ELFEXT, ACR, PSNEXT, PSELFEXT, and PSACR. Detailed test results for each link will also include customer site name, name of standard selected to execute the tests, date and time test results were saved in memory of test unit, brand name model and serial number of tester and revision of the tester software and test standards database in the tester. Individual test data within each section shall be presented in the sequence listed in the test summary records. Unless a more frequent calibration cycle is specified by the manufacturer, an annual calibration cycle is anticipated on all test equipment used for this installation.

13. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be collocated in the binder.
14. The entire SCS system shall be warranted free of mechanical or electrical defects by the Contractor for a period of one year after final acceptance of the installation.
15. Any equipment that is not installed per the manufacturer's recommendation shall be replaced promptly and at no cost to the District.
16. Any material showing mechanical or electrical defects shall be replaced promptly at no expense to the District.
17. Provide all labor and material warranties for each system, as described elsewhere in this document.
18. At the District's direction, the Contractor shall perform additional random testing which shall consist of a random sample of up to 10% of each installation distribution system. The Contractor shall assume responsibility for providing the proper test equipment and staff to conduct tests. The District's representative shall witness the tests.
19. Should the initial 10% test not be 100% successful (all drops testing over CAT6 up to 250MHz), the Contractor shall assume responsibility to repair/replace non-passing links, at the direction of the District, and the links to re-verify and resubmitted. A 20% random sample shall then be conducted to ensure proper performance of the system.
20. Should there be failure in this re-test, the Contractor shall be responsible to repeat the re-test procedure until such time as all cabling is verified.

3.7 COMPLETION OF WORK:

- A. At the completion of the Systems, the SCS Contractor shall restore to its former condition, all aspects of the project site, and daily shall remove all waste and excess materials, rubbish debris, tools and equipment resulting from or used in the services provided under this Contract. All clean up, restoration, and removal noted above will be by the Contractor and at no cost to Owner. If the Contractor fails in its duties under this paragraph, Owner may upon notice to the Contractor perform the necessary clean up and deduct the costs thereof from any amounts due or to become due to the Contractor. It shall be the Contractor's responsibility to remove trash from the areas it is working in and bring trash and debris to the Contractor provided dumpster.

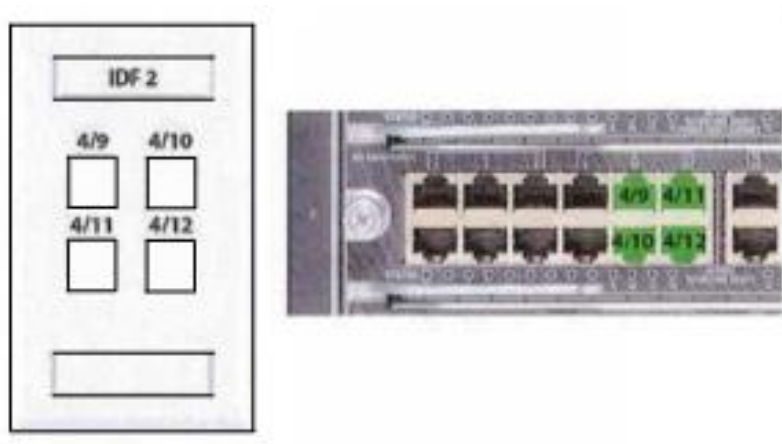
3.8 INSPECTION

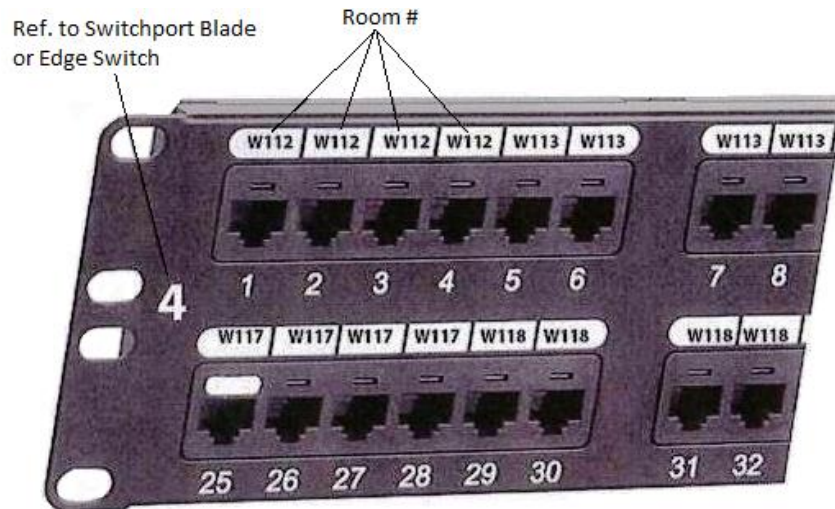
- A. On-going inspections shall be performed during construction by the District's representative. All work shall be performed in a high-quality manner and the overall appearance shall be clean, neat, and orderly. Any work that does not meet the

District's representative's approval shall be removed and reinstalled by the Contractor at no additional cost to the District.

3.9 LABELING REQUIREMENTS

- A. Numbers must be assigned to each outlet location using a logical designation convention. Blueprints with the outlet placement and configuration information have been furnished to the Contractor. Contractor will provide the equipment as necessary to generate Panduit PAN-CODE (or Equal) laser printer generated self-laminating labels using the numbering convention shown below and as specified herein. Before any permanent labels are installed on blocks, face plates or cables, Contractor shall submit a sample label of each various type listed below to District's Project Manager for written approval to ensure compliance with the labeling scheme, legibility, etc. Contractor is responsible to provide the labeling scheme as described herein.
- B. Station Faceplate (Telecommunications Outlet) Labeling. The following is illustrative of the number convention to be used:
 1. Top Window: IDF-2. This identifies the IDF location where cable originates within the building (i.e., IDF room "#2").
 2. Bottom Window: blank. For future use.
 3. Faceplate jacks shall be numbered sequentially from top to bottom and left to right. Individual jack labels shall indicate Patch Panel number / port number. (i.e., 4/9 represents patch panel #4, patch panel port #9).





- C. Network Switch Labeling. All rack mounted Ethernet edge switches shall be sequentially numbered. Number shall be printed and attached to the left edge and centered. Numbers shall be minimum 1/2" high and printed white on a black background.
- D. Patch Panel Labeling. All copper category 6 and 6A rack mounted patch panels shall be sequentially numbered, beginning with the uppermost panel in the rack. Patch panel number shall be printed and attached to both left and right edges and centered. Numbers shall be minimum 1/2" high and printed white on a black background. Patch panel ports shall be labeled with the corresponding room number where the cable's faceplate is located. Cables shall be terminated sequentially by room number and faceplate order.
- E. Station Cable Jacket Labeling. All Category 6 and Category 6A cables shall be labeled within six inches of each termination end (e.g., at both ends, outlet end and MDF/IDF end) using machine-generated, "P-Touch" type, self-laminating cable markers.
1. Example: IDF2-4/9
 2. IDF location where cable originates (i.e., IDF room "#2").
 3. Patch panel and port numbers where cable terminates (i.e., patch panel #4, port #9)
- F. Backbone and Riser Multipair Cable Labeling. All backbone and riser cables (copper, fiber, coax, etc.) will be labeled to reflect the origin and destination abbreviation for the cable and pair counts on large font (16 pitch) self-laminating labels, which shall be located within 18 inches of each end of the cable. Labels shall be placed on the cable to be visible without relocating surrounding cables.
1. Example #1: IDF2/IDF3/CP100/01
 2. IDF2: Cable Origination

3. IDF3: Cable Destination
 4. CP100: Cable Type & Pair or Strand Count (ex. 100 – pair Copper Cable. Other possibilities include CX for coax, HB for hybrid fiber cable, MM for multimode cable, and SM for single mode cable.)
 5. 01: Cable identification number (ex. cable 01). There may be more than one backbone or riser cable with the same origin, destination, and pair count.
- G. Multipair Cable Termination Block Labels. All multipair cables will be labeled using appropriate terminal-block label strip with label holders. Termination blocks shall be labeled in such a manner to indicate Termination Block number (ex: W1, W2, etc.) and type of cables (ex. Fire Alarm-FA, Security Alarm-SE, Paging-PA, FAX machine, etc.).
1. Termination Block Label:
 2. Example: W1 – Alarm Cables 1st Floor
 1. W1: Wall Field 100-pair 110-block #1
 2. Individual cable numbers on label strip:
 3. Example: 001
 4. Station #1
- H. Multipair Cable Termination Block Labels. All multipair riser blocks shall be labeled using appropriate terminal-block label strip with label holders and shall follow the labeling scheme outlined above. Building interconnect cable termination block labels shall be per ANSI/TIA/EIA-606-B. Final label scheme shall be determined by the District's decision.
- I. Fiber Enclosure Labels. All fiber enclosures and panels will be labeled using self-laminating laser label markers. Fiber labels shall include all information as specified by the District. Contractor is responsible to provide a labeling scheme that meets with the District's satisfaction. At a minimum, the fiber enclosure label card shall indicate: destination of connected cables, slash (/), origination of connected cables, slash (/), and the fiber enclosure number and port number.
1. Example: MDF/IDF2/1-1
 2. MDF: Destination Patch Panel Location Designation
 3. IDF2: Origination Patch Panel Location Designation
 4. 1-1 Indicates fiber enclosure number and fiber port number on both origin and destination fiber enclosures.
- J. Equipment Rack/Cabinet Labeling: All equipment racks/cabinets shall be labeled according to their room identifier and a two-digit number. The labels will be engraved plastic plates, with 1"-high white letters on black background. The labels

will be attached to the cross member at the top front of each frame or rack with appropriately sized sheet metal screws. Self-adhesive strips, glues, etc. are unacceptable. Racks and cabinets within the same room shall be numbered sequentially from left to right, when facing the front of the racks/cabinets.

1. Example: MDF-01
 2. MDF. Room Designation
 3. 01. Rack Identifier
- K. Innerduct and Fiber Cable Warning Labeling. The Contractor shall provide and install tags of stamped plastic for tube cable and innerduct. The labeling convention described above within Paragraph E shall apply. Additionally, the Contractor will also install fiber optic warning tags (Panduit #PST-FO) every 12 feet on all exposed fiber optic cable and on innerduct containing fiber optic cable installed within the building, also on innerduct and cable visible in each pull box, manhole, and vault.
- L. MDF/IDF Floor Plan Mounting Frame: Provide wall mountable floor plan mounting frame with removable Plexiglas front cover in each MDF/BDF/IDF. Frame and cover shall be sized to house 30"x42" floor plan drawing. Coordinate location of frame with District's Project Manager prior to installation.
- M. Telecommunications Main Grounding Busbars (TMGB, TGB): All telecom grounding busbars shall be labeled using large font (16 pitch) self-laminating labels. Labels shall indicate "TMGB" or "TGB". If more than 1 busbar is in the room, include a numerical indication (ex: TMGB-1).

3.10 MISCELLANEOUS PROJECT REQUIREMENTS

- A. Site Cleaning: Throughout the progress of the plant construction, the SCS Contractor shall keep the working area free from debris of all types and remove from the premises all rubbish resulting from any work done by Contractor. Daily, and at the completion of its work, the Contractor shall, to the extent possible, leave the premises in a clean and finished condition.
- B. Conduits: All backbone cabling will run through dedicated conduits. All new conduits will be supplied with a pull string. SCS Contractor shall supply pull string and pull rope for the installation of all cables in existing conduits. For all conduits left with available capacity, SCS Contractor shall replace pull strings with ¼-inch pull rope during his work. Contractor must seal all underground low voltage conduits within manholes, underground vaults/pull boxes, and underground conduits that enter a facility, with an approved mechanical water/gas/airtight plug. Unused conduits shall be sealed with a blank plug.
- C. Seismic Requirements: SCS Contractor will install all equipment racks, equipment cabinet enclosures, cable runways, etcetera, according to DSA and local, state and/or federal code. Contractor will notify District's Project Manager of such requirements and shall provide such bracing as required. Contractor to coordinate all installation with the structural Engineer of Record.

- D. Safety Requirements: SCS Contractor will utilize appropriate personnel and display warning signs, signals, flags and/or barricades at the work site to ensure adherence to safety regulations and as prudence requires.
- E. Specification/Drawing Status: All specifications and drawings related to this project will be “frozen” after shop drawing approval. The District reserves the right to negotiate any future changes with the Contractor at any time.

3.11 MISCELLANEOUS SUPPORT REQUIREMENTS

- A. Upon approval of shop drawings, SCS Contractor shall immediately place orders for all required materials, components, and supplies. In addition, Contractor shall secure and forward written confirmations (including orders and shipping dates) direct from each manufacturer/vendor to the District’s Project Manager.
- B. SCS Contractor shall expedite shipment of all materials, components and supplies, as necessary to ensure the successful completion of the Project by the date required. All costs for expediting shall be included within Contractor’s pricing as provided below.
- C. The system cost herein shall include administration/maintenance training for at least five (5) District representatives with a minimum allotment of two (2) eight-hour sessions. All training shall include written and/or video materials that shall remain the property of District. If materials are written, they shall be provided in quantities sufficient for each person trained; if materials are video, one (1) copy of each will be required. The administration/maintenance training shall include, but not be limited to, the following:
 - 1. Review of as-built documentation, including a site demonstration.
 - 2. All warranty information.
- D. Minimum standards for maintenance purposes shall include optional access to service on a 24 hour-a-day, 365 day-a-year basis. In addition, Contractor shall, upon notification, respond as follows:
 - 1. Emergency Response: Contractor must respond by utilizing remote diagnostics capabilities (as applicable) within thirty minutes of notification. If necessary, Contractor must dispatch at least one certified technician for arrival on-site within two hours of notification.
 - 2. Non-Emergency Response: Contractor shall respond by utilizing remote diagnostics capabilities and or cause dispatch of at least one certified technician for arrival on-site within one business day of notification.
 - 3. Definition of “Emergency”: For maintenance purposes, “emergency” shall be defined as one or more of the following conditions:
 - a. Defects of any riser pairs and/or components involving at least ten percent (10%) of any riser cable’s capacity.

- b. Defects of station cable pairs and/or components involving at least ten percent (10%) of any department or group of voice and/or data stations.
- c. Defects significantly impairing any single attendant console.
- d. Defects of any fiber optic cable and/or components involving at least ten percent (10%) of any department or group's fiber-based systems and/or stations.
- e. Any pre-defined failure as submitted by District and agreed to be Contractor.

3.12 FINAL ACCEPTANCE

- A. The District or District's representative may visit the site during the installation of the system to ensure that correct installation practices are being followed.
- B. The District or District's representative will conduct a final job review once the Contractor has finished the job. Review will take place within one (1) week after the Contractor notifies District.
- C. Two (2) copies of all certification data and drawings for all identifications shall be provided to the District before the District's review.
- D. The District or District's representative will review the installation and certification data prior to the system acceptance.
- E. The District or District's representative may test some of the systems features to ensure that the certification data is correct. If a substantial discrepancy is found, the District reserves the right to have an independent consultant perform a certification of the entire system. If such a procedure is undertaken, the cost of the testing will be billed back to the Contractor.
- F. In the event that repairs or adjustments are necessary, the Contractor shall make these repairs at his own expense. All repairs shall be completed within ten (10) days from the time they are discovered.
- G. The Contractor shall provide two (2) copies of an "operating and servicing manual" for the system within fourteen (14) calendar days of District's final acceptance of the system. The manuals shall be bound in flexible binders. All data shall be printed material or typewritten. Each manual will include the following: instructions necessary for proper operation and servicing of the system; complete as-built installation drawings of the system (11"x17"); equipment specification cut sheets, complete performance test data, complete warrantee information and replacement parts list with current prices listed, contact information for repair and warranty work requests.
 - 1. The Contractor shall mount a full size 30" x 42" bond copy of each scaled Site Plan within MDF room and each IDF room with removable Plexiglas front cover. Frame and cover shall be sized to house the site plan and floor plan

drawings. Coordinate location of frame with District's Project Manager prior to installation.

2. The Contractor shall hand to the District a copy of any applicable installation specific software configurations including all log-in passwords in CD format.

END OF SECTION

SECTION 27 51 23

INTERCOMMUNICATIONS PAGING AND CLOCK SYSTEM

PART 1 - GENERAL

1.1 INCLUSION OF GENERAL CONDITIONS

- A. The applicable provisions of Division 1 and the General Conditions, Supplementary Conditions, and General Requirements are a part of these specifications.

1.2 SCOPE OF WORK

- A. Modify, expand, and revise the existing system and provide additional materials, labor, equipment, testing, and documentation for a complete intercom, paging and clock system including, but not limited, to the following:
 - 1. Connection to existing intercom/paging/clock system main console.
 - 2. Modifications to main control console (existing)
 - 3. Room speakers
 - 4. Exterior speakers
 - 5. Cabling, terminations, and connections.
 - 6. Telephone stations and handsets
 - 7. Room clocks
- B. Provide testing, final commissioning and Owner training.

1.3 RELATED WORK

- 1. Section 26 00 00: Common Work Results for Electrical
- 2. Section 27 10 00: Structured Cabling

1.4 QUALITY ASSURANCE

- A. The equipment, devices, and systems to be supplied by a single Contractor.
- B. The Contractor shall hold the necessary valid C-7 or C-10 California State Contractors License.
- C. Contractor shall have a minimum of five (5) years' experience installing intercom / public address / clock systems and devices.
- D. Contractor shall be manufacturer trained in the proper installation, programming, testing, and operation of the system. Contractor shall include all current manufacturer training

certifications in the bid submittal showing that the submitting Contractor is qualified to install and maintain all of the equipment included in the Contractor's submittal package.

- E. After-sales support: The contractor shall provide current letter of recommendation from manufacturer addressed to the District. The contractor shall be a trained dealer of the system and shall be factory-trained and certified to maintain and repair the system after system acceptance.

1.5 SUBMITTALS

- A. Provide a complete materials list and cut sheet submittals for all components and equipment, including the following:

1. Amplifiers and expansion modules
2. Clocks
3. Room Speakers
4. Outside paging speakers
5. Intercom handsets (when called out on the plan drawings)
6. Backboxes and specialty rough-in items
7. Terminal cabinets and termination blocks
8. Wire, cable, jacks.

- B. Point-to-point wiring diagrams

1. Show and identify all devices, interconnections, and wire type.
2. Identify devices according to name, function, and manufacturer's catalog numbers, and indicate their locations on the drawings.
3. Show connections to existing console.
4. Scale: 1/8" = 1'-0"

- C. Floor Plans

1. Floor plan drawings shall be scaled per the bid set drawings, and include a symbols list, all components, devices, cabinets, conduits, conduit sleeves, and building interconnections.
2. Floor plans shall include identification tags and shall correspond to the point-to-point wiring diagrams.

- D. Details

1. Mounting details for all wall and ceiling mounted devices.

1.6 WARRANTY

- A. Warranty the complete fully functional Intercom/PA/Clock system.
 - 1. Wiring, equipment and connections shall be free from defects in workmanship and materials.
 - 2. The warranty shall be effective for a period of one year and shall commence at the date of acceptance of the system.
 - 3. All labor and material costs to be included.
- B. The Contractor shall make available, and maintain, a radio dispatched mobile service department capable of furnishing equipment inspection and timely service at the Owner's location.
- C. The Contractor to offer a service contract for the maintenance of the system beyond the warranty period.

1.7 PERFORMANCE AND FUNCTIONS

- A. The communications system shall provide a comprehensive microprocessor controlled, multiple talkback network between telephone stations and intercom speakers.
 - 1. There shall be one 12 Watt talkback amplifier and one 20 Watt paging amplifier for every 24 speaker stations in the system.
 - 2. Provide remote booster amplifiers where required.
- B. The speaker control central processor and switching unit shall be of the modular plug-in printed circuit board type, using HMOS microprocessor and TTL logic with HCMOS memory and sensing.
 - 1. CMOS circuitry shall be protected with transient suppression devices on all inputs and outputs.
 - 2. Non-volatile EPROM shall store field programmable memory.
- C. The system shall provide no less than the following features and functions:
 - 1. Complete DTMF signaling, dial tone and busy signals to the telephone control microprocessor.
 - 2. Amplified-voice communication with loudspeakers from any system telephone with automatic VOX switching. The system shall provide up to 8 simultaneous amplified-voice intercom communications over staff loudspeakers.
 - 3. The system shall be expandable to over 200 total stations.
 - 4. Provide system-wide emergency all-call feature. The emergency all-call shall be accessed at designated staff or administrative phones or by Emergency handset or by the activation of contact closure (which shall also give program input #3

emergency status). The emergency call-call shall capture complete system priority, shall be transmitted over all speakers, and shall activate an external relay for control of external functions.

5. Provide four (4) built-in alarm tones, each accessed by dialing a three-digit number from designated administrative telephones.
6. Provide four (4) external driver outputs, for activation of television system switching and other external control functions as specified, accessible by dialing a pre-determined number from designated administrative telephones or automatically programmed in software, to be determined by the Owner.
7. Provide integral program material interface which shall accept up to 3 program /control modules. This shall contain input modules for program sources and digital announcement messages as specified herein and shall allow for input matching and level control of program into the system speakers. Program distribution control shall be made available to authorized system telephones as allowed by programming.
8. The system shall provide for field-programmable three or four-digit architectural speaker station numbers, to match the building architectural numbers.
9. An architectural-number/station-number cross-reference shall be field-accessible to facilitate service.
10. There shall be an automatic level control for return speech during amplified-voice communications.
11. Each station loudspeaker shall be assigned to any of eight paging zones, plus all call. It shall be possible via programming to exclude a station from all-call paging.
12. Each station loudspeaker shall be assigned to any of eight time-signaling zones. These zones shall be independent of paging zones.
13. There shall be 8 time-signaling schedules with a total of 1048 user-programmable events. Each event shall sound one of 8 user-selectable tones. It shall be possible to assign each schedule to a day of the week, or manually change schedules from a designated administrative telephone. It shall also be possible to assign relay control to the time events.
14. An internal program clock (with battery back-up) shall be included in the system. It shall be possible to synchronize the program clock with an external master clock.
15. There shall be a pre-announce tone signal at any loud-speaker selected for amplified-voice communication. The pre-announced tone shall be disabled by programming.
16. There shall be a periodic privacy tone signal at any loud-speaker selected for amplified-voice communication. The privacy tone shall be disabled by programming.

17. There shall be an automatic disconnect to prevent tying up communications channels. When a telephone is lifted from its cradle and does not initiate a call within ten (10) seconds, the station shall receive a busy signal.
18. The entire system shall include diagnostic / programming software for system testing and for full remote maintenance.
19. The system will also provide, via field programming, for the disconnect of the speaker when its associated telephone is lifted from the cradle. The system shall allow individual paging of a classroom speaker from a classroom phone by simply dialing "*" and the 3-digit room number. Systems which do not offer such selective paging shall not be acceptable.
20. The telephone will be capable of generating an emergency call by flashing the hook button three times. Emergency calls can be programmed to ring a single administrative phone.
21. Any classroom telephone will also be allowed to access any one of the three program sources, and turn on and off the program sources to that related speaker.
22. It shall be possible to configure the system with non-dial handsets, call switches, administrative display phones and speakers. It shall be possible to program each station location as a staff station (handset or speaker and call-in switch), or administrative station (keypad-dialing DTMF telephone and alphanumeric display panel).
23. The staff stations may be programmed to ring one administrative telephone during day hours and one administrative telephone during night hours. Day and night hours shall be user-programmable.

PART 2 - PRODUCTS

2.1 RACEWAYS, PATHWAYS, AND BOXES

- A. Provide required conduit, wireway, junction boxes, and pull boxes.

2.2 MAIN CONSOLE

- A. Existing Bogen Multi-Comm 2000
- B. Provide modifications and additional components as required to accommodate all new intercom telephone handsets, speakers, and clocks shown on the plan drawings.
- C. Provide additional amplifiers for remote buildings, and as required, to maintain signal levels within nominally acceptable values for all devices connected on the system.

2.3 TELEPHONES

- A. Wall or desk mounted, when shown on the plan drawings
- B. DTMF dialing with 12- pushbutton keypad

- C. Housing molded high impact ABS plastic
- D. Color: beige
- E. Dynamic receiver and carbon transmitter
- F. Coil cord
- G. Manufacturer: Bogen MCWESS and MCESS

2.4 SPEAKERS

- A. Interior speakers:
 - 1. 8" cone type loudspeaker
 - 2. 6 oz Ceramic magnet
 - 3. Frequency response: 50 Hz to 12 KHz
 - 4. Power rating: 7 Watts
 - 5. Axial sensitivity: 95 dB
 - 6. Impedance matching transformer: matches 8 Ohm speaker to 25 or 70 Volt line with power taps of 4, 2, 1, ½, ¼ and 1/8 Watts.
 - 7. Grille: steel type sized for 8" cone type speaker. Diameter 13". White semi-gloss enamel finish.
 - 8. Tile bridge: load bearing T-bar support to sustain weight of 8" speaker and enclosure.
 - 9. Manufacturer: Bogen
 - a. S86 speaker
 - b. S86T725 transformer
 - c. PG8W grille
 - d. TB8 tile bridge.
- B. Exterior Weatherproof Speakers:
 - 1. Double re-entrant type with compression driver mounted within waterproof housing.
 - 2. Surface mount
 - 3. Power rating: 20 Watts equalized

4. Frequency response: 475 Hz to 14KHz
5. SPL: 121 dB (4 ft on axis, 15 Watt input)
6. Dispersion: 160 degrees
7. Impedance: 8 Ohms
8. Transformer with power taps at 15, 7.5, 3.8, 2, and 1
9. Heavy duty construction, grey baked epoxy finish
10. Baffle: recessed vandal resistant, heavy duty security grille 1/4" thick cast aluminum.
11. Enclosure: recessed enclosure fabricated of .036 CRS undercoated to eliminate acoustical and mechanical resonance. Conduit knockouts; adjustable to final tile or plaster finish.
12. Manufacturer:
 - a. Atlas/Soundolier APF-15T speaker
 - b. Lowell SQLK-8-APF recessed baffle (with special tools)
 - c. Lowell P875X-6 enclosure.

2.5 CLOCKS

- A. Synchronous wired, analog type, semi-flush wall clock.
- B. Dial dimensions: 12.12" diameter
- C. Overall projection from the wall: 1.62"
- D. Classroom clocks shall be Lathem model SS12RFAB 24 Volt A/C. Clock back box shall be Lathem model SAM0756.
- E. Synchronous motor and brass movement for local timekeeping and a correction coil for synch with a master control unit.
- F. Manufacturer: Lathem

2.6 COMBINATION CLOCK SPEAKER ENCLOSURES

- A. Recessed enclosure for common clock/speaker applications
- B. Heavy gauge cold rolled steel construction
- C. Acoustically treated interior surface
- D. Knockouts: 1/2" and 3/4"

- E. Low voltage center barrier
- F. Rust retardant grey primer finish
- G. Hinged baffle
- H. Provide wire guard for gymnasium locations
- I. Manufacturer: Bogen PC-312 enclosure with MC-300 baffle

2.7 SYSTEM CABLING

- A. Intercom cabling: cabling for classroom speakers and handsets shall consist of 1 twisted pair #22 solid copper under jacket and 1 twisted pair #22 under shield solid copper with overall PVC jacket, West-Penn #357.
- B. Horizontal telephone cable: Category 6 UTP cable: Unshielded, 4 twisted-pair, 23 AWG copper, CEC Article 800 type CMP rated, plenum type, extended performance, tested to 500 MHz, refer to section 271000 for cat-6 data cable specifications.
- C. Paging speaker cabling: Cabling to separate paging speaker installed in hallways, corridors, and building exterior shall be single twisted pair, shielded, #20 AWG stranded copper, West-Penn #292.
- D. No splices are permitted except in approved junction boxes. All terminations shall be made on 66M type punch blocks or at specified devices. Display, speaker, and specialty cables shall be as required for best operation under manufacturer recommendations.

2.8 SYSTEM TERMINATIONS AND ORGANIZATION

- A. Jacks: All station device terminations (except speakers) shall be terminated on USOC standard modular jacks. Jacks for wall mounted telephones shall have lugs for securely attaching the instrument to the wall.
- B. Where instruments are to be wall-mounted, provide mounting studs on the faceplate. Faceplates are to be stainless steel AT&T #630B or equal.
- C. Backboards: Provide 4' x 4' painted plywood backboards for mounting of system cross connect field. Mount as shown on the plans. Provide Modular Termination backboards with 110 type terminal blocks as required to terminate all cables. Provide Distribution and cross connect backboards equal to 66M Harris Series for all cross connect wiring.
- D. Terminal Cabinets: A terminal cabinet with a sufficient number of bushed openings shall be installed in the wall behind the Intercom Control Console equipment rack. Cabling between the equipment rack and the main junction box shall be provided with telephone type 50 pin Amphenol connectors to allow ease in console connections, disconnections, and service. Satellite terminal junction boxes shall be provided as needed to allow for station terminations in each building.

2.9 SYSTEM ACCESSORIES

- A. The communications Contractor shall furnish all equipment, accessories and material required for the installation of a comprehensive clock/signal/telephone communications system. Include all material, devices, equipment, connections, and wiring not specified or described herein but necessary for the proper operation of the system.

PART 3 - EXECUTION

3.1 WIRING

- A. A comprehensive, documented communications wiring system is to be installed.
 - 1. Wiring is to be identified by room number, segregated, neatly laced, and terminated on telephone type punch blocks.
 - 2. Back boards and cross connect fields shall be neatly organized as to function, (i.e., intercom, clocks, telephone stations, etcetera).
 - 3. All termination points are to be labeled with function.
 - 4. Data cables shall be certified as usable and verified using the appropriate cable analyzer.
 - 5. Data cables shall be labeled as per the data identification scheme.
- B. Splicing
 - 1. Make splices at punch-down blocks on backboards in the MDF and IDF rooms.
 - 2. Splices are not permitted in underground pull boxes or any other location other than on backboard punch-down blocks.
 - 3. Provide machine generated labels at all terminations.

3.2 TESTING

- A. Prior to connection of any terminal equipment, all cables shall be fully tested as per REA spec PC-4:
 - 1. All cables shall be tested for Opens, Splits, Crossed Pairs, Shorts, Shorts to Ground, and Shield Continuity.
 - 2. All defective cabling is to be replaced prior to device hook-up.
- B. Upon completion of the installation:
 - 1. Test each room station speaker, handset, or call switch for proper operation.
 - 2. Test each interior common area, and exterior area, speakers for proper operation.
 - 3. Adjust all interior and exterior speakers for appropriate sound level settings.
 - 4. All telephones, programming, and functions are to be tested for proper operation.

5. Test each individual paging zone for proper zone operation.
6. Test All Page function for proper operation.
7. All emergency and program functions are to be tested.
8. Any malfunction shall be corrected and verified prior to final acceptance.

3.3 SYSTEM PROGRAMMING

- A. Provide complete programming of the existing system to accommodate new devices.
- B. Program clocks to suit district time schedule.
- C. Program system for new telephone handset use.
- D. Program system operational zones. Coordinate directly with District for all zoning requirements.

3.4 SPEAKER TRANSFORMER TAPS

- A. Set transformer taps on all speakers.
- B. Indicate final tap settings of each speaker on final as-built drawings.
- C. Test each tap for adequate sound level dB over normal space ambient.

3.5 TRAINING AND OWNER INDOCTRINATION

- A. The Contractor shall instruct the Owner's personnel in the proper operation, basic care, basic programming, and maintenance of the system and equipment.
- B. Such training shall be provided as an integral component of the system.
- C. Contractor's bid shall include providing a minimum of two (2) hours of hands-on training to the District's staff. Contractor shall coordinate training with District's schedule.
- D. The Contractor will also provide the Owner with limited programming access to the system. This programming will be executed utilizing plain English menus, from any authorized administrative phone, to assist the Owner with all necessary changes.
- E. The main programming for the system shall be PC Windows based for ease of operation. Systems that do not use plain English menus and Windows based PC programming and are only programmable from a laptop PC will not be accepted as equal.

END OF SECTION

SECTION 28 16 00

INTRUSION DETECTION SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. The Contractor shall modify, expand, and program the existing First Alert Intrusion Detection System (IDS), in accordance with the bid documents, the result shall be a fully functional and operational system per manufacturer's guidelines, codes and specification requirements.
- B. Provide all labor, engineering, design, testing, materials, components and supervision necessary to provide a complete operating Intrusion Detection system (IDS).
- C. Provide District training per District requirements, (see Training Requirements subsection in this document).

1.2 RELATED SECTIONS

- A. Section 26 00 00 – General Electrical
- B. Section 27 10 00 – Structured Cabling System

1.3 SYSTEM DESCRIPTION

- A. The existing system shall be expanded to include the additional detection and initiation devices as shown on the bid documents.
- B. The Contractor shall provide all additional electronic and passive components including expansion boards and modules, power supplies, POPIT modules, detectors, keypads, cabling, terminal blocks, cabinets, etcetera as required for a fully functional intrusion detection and alarm system.

1.4 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI C63.4 Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
- B. Canadian Standards Association (CSA):
 - 1. CAN/CSA E60950-1 Information Technology Equipment Safety.
- C. Federal Communications Commission (FCC):
 - 1. FCC CFR 47 part 15 class A - Telecommunications - Radio Frequency Devices - Digital Device Emission.

- D. International Organization For Standardization (ISO):
 - 1. 9001 - Quality System.
- E. Underwriters Laboratories, Inc. (UL):
 - 1. UL 50 Enclosures for Electrical Equipment.
 - 2. UL 2043 Fire Test for Heat and Visible Smoke Release for Discrete Products and their Accessories Installed in Air-Handling Spaces.
 - 3. UL 60950-1 Information Technology Equipment - Safety.

1.5 SUBMITTALS

- A. Contractor is to submit the following prior to construction for Contractor and District approval.
- B. Contractor will provide, prior to installation, a current letter of recommendation from the manufacturer, addressed to the District. Letter of recommendation must be given to General Contractor at time of bid. Contractor must be certified with the manufacturer at least twelve (12) months prior to letter of recommendation.
- C. Contractor will provide data of installer's experience and qualifications, which shall include 3 years on projects of similar complexity. Include names and locations of two projects successfully completed using an Intrusion Detection System. Include written certification from users that systems have performed satisfactorily for not less than 18 months. Product Data: Manufacturer's data, user and installation manuals for all equipment and software programs including computer equipment and other equipment required for a complete Intrusion Detection System, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
 - 4. Labeling Schematic for cabling and components. Security contractor must coordinate with Electrical contractor for labeling of cabling.
 - a. Label all panels as to the function and location on the inside of the panel door.
 - 1) Label with function first.
 - a) *Example:* FA for Fire or SEC for Security
 - 2) Label with building designation next.
 - a) *Example:* A – A Bldg. or 100 – 100 Bldg.
 - 3) Label with room location next.

- a) *Example:* Electrical (Elect), or Custodial (Cust). or Rm. 215
- 4) Label cabling at each end to/from their destination.
 - a) *Example:* SEC – 200 Bldg. – Elec- 3
 - (1) SEC = Security
 - (2) 200 Bldg. = Building 200
 - (3) Elec = Electrical Room
 - (4) 3 = Panel 3
 - b. Inside terminal boxes:
 - 1) Label cabling at each end to/from their destination
 - 2) Label components in boxes with address and destination
 - 3) Label components at rooms with address and location of terminal panel
- D. Shop Drawings: Shop drawings shall provide details of proposed system and the work to be provided. Include point-to-point drawings of systems and wiring diagrams of individual devices.
 - 1. Detailed wiring diagrams and system description.
 - 2. System device locations on architectural floor plans.
 - 3. Full Schematic of system, including wiring information for all devices.
- E. The Contractor will coordinate with District representative for definition of system nomenclature. The District will approve during submittal process.
- F. Training Schedule: Training schedule to provide details for the District staff. Include time line with class types and descriptions and amount of people that can attend along with location.
 - 1. Comprehensive training includes keypad with site staff four (4) hours.
 - 2. Advanced training that includes integration with other systems, for technician's familiarization with the system.
 - 3. Training to be coordinated with security vendor through the manufacturer. See training time line and schedule.
- G. Documentation to be submitted by the Contractor upon completion of system installation:
 - 1. "As-builts": Upon completion of installation, the Contractor shall prepare "as-built" drawings of the system. These "As-builts" shall be 30 inches by 42 inches (76 cm

by 107 cm) format mylar reproducible drawings of each floor plan indicating exact device locations, panel terminations, cable routes and wire numbers as tagged and color-coded on the cable tag.

- a. Additionally, final point-to-point wiring diagrams of each type of device (on 30 inches by 42 inches (76 cm by 107 cm) format) shall be included in the "as-builts."
 - b. "As-builts" shall be submitted to the Owner for approval prior to the system acceptance walk-through.
2. "As-Builts" shall be submitted to the contractor for approval prior to the system acceptance walk-through.
 3. Operation and maintenance manuals: Three sets of operating manuals shall be provided electronically and in written binder format explaining the operation and maintenance of the system.
 4. Parts list and quantity of each part.
 5. Maintenance required and maintenance schedule.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualification:

1. The system shall be the standard product of one manufacturer, and the manufacturer shall have been in business manufacturing similar products for at least 5 years.
2. Manufacturer's Quality System: Registered to ISO 9001:2000 Quality Standards.

B. Installer Qualification:

1. Minimum of five years' experience installing access control, surveillance and security systems and devices.
2. After-sales support: The Contractor shall provide current letter of recommendation from manufacturer addressed to the District. The Contractor shall be a trained dealer of the system and shall be factory-trained and certified to maintain/repair the system after system acceptance.

C. System Requirements:

1. All equipment, systems, and materials furnished and installed under this section shall be installed in accordance with the applicable standards of:
 - a. National Codes: NEC, NFPA, UBC, BOCA, SBCCI, IBC as applicable.
 - b. Approvals and listings: UL, FM, (ANSI CP-01, CSFM, NYC-MEA, as applicable.

- c. Local Authorities Having Jurisdiction (AHJ).
- D. Mock-Up: provide a mock-up for evaluation of installation techniques and application workmanship. Provide pictures of previous panels fully dressed out and include shop drawings.
 - 1. Finish system in areas designated by Architect.
 - 2. Do not proceed with remaining work until workmanship and aesthetics are approved by Architect.
 - 3. Remake mock-up area as required to produce acceptable work.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original new, unopened, undamaged containers; and unharmed original identification labels.
- B. Store products in manufacturer's unopened packaging until ready for installation.
- C. Protect store materials from environmental and temperature conditions following manufacturer's instructions.
- D. Handle and operate products and systems according to manufacturer's instructions.

1.8 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.9 WARRANTY

- A. All components, parts, and assemblies supplied by the manufacturers and installed by the Contractor shall be warranted against defects in material and workmanship for a period of at least two (2) years (parts and labor), commencing upon date of acceptance by Owner. A qualified factory-trained service representative shall provide warranty service.
- B. Warranty Period:
 - 1. System maintenance and repair of system or workmanship defects during the warranty period shall be provided by the Contractor free of charge (parts and labor).
 - 2. The installer shall correct any system defect within six (6) hours of receipt of call from the Owner.
 - 3. Extended service/maintenance agreements shall be offered by the Contractor for up to an additional two (2) years beyond the regular 2 year warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: First Alert, existing on campus.

2.2 SYSTEM CAPABILITIES, CAPACITIES, AND FORMATS

- A. Number of Loops/Sensors will be determined by the project site needs.
- B. The system shall offer 8 partitions.
- C. The system will support up to 128 zones using basic hardwired, polling loop and wireless technologies.
- D. Programming Point Functionality: Each point in the system shall provide for the following type of response in the system.
 - 1. Always on (24 hour response).
 - 2. On when the system is Master Armed.
 - 3. Only on when the system is Perimeter Armed.
 - 4. Displays / Does Not Display at the ACC when the point is activated.
 - 5. Provides / Does Not Provide entry warning tone.
 - 6. Sounds / Does Not Sound audible alarm indication.
 - 7. The Point is by-passable / not by-passable.
 - 8. Alarm Verification with programmable verification time.
 - 9. Relay activation by Point.
 - 10. Provides / Does Not Provide "watch point" capability.
 - 11. Provides Swinger Bypass.
 - 12. Defers Bypass Report.
 - 13. Can return to the system after being force armed and then restoring.
 - 14. Can return to the system after being bypassed and then restoring.
- E. The IDS shall be capable of logically grouping 2 or more points into an area, or conversely, dividing the points into two or more areas.
- F. Any area shall be configurable to allow arming by specific users when a programmable number of devices are faulted or bypassed.

- G. Areas shall be independently controlled by their corresponding ACC. Each ACC can be designated to control a specific area, or group of areas, or all areas in the system.
- H. Independent control or relay functions by area shall be possible through programming assignments.
- I. Testing, Diagnostic, and Programming Facilities: Automatic test reports and remote system access for diagnostics, programming, and log (Logger) uploads shall also be supported via a remote central station computer utilizing the RPS software.
- J. Relays and other outputs may be programmed to follow up to 14 different area conditions or up to 12 panel conditions. Relays may also be programmed to follow individual points or groups of points.
- K. The system can be configured to provide zoned indication of alarm conditions.
- L. The IDS shall include an early ambush feature that requires that the user disarm, and then inspect the facility within a specified time period, before entering their passcode again. If the user does not enter their passcode a second time, a duress event is generated. If the end user does enter their code within the specified time period, the system disarms. In addition, the system must have a programmable feature that requires that two passcodes are entered to disarm the system. After one code is entered, the system will prompt for a second code.

2.3 SYSTEM HARDWARE:

- A. The existing IDS control panel is First Alert Systems model FA1600C.
- B. IDS: Contractor shall expand existing control panel and provide all necessary system accessories and other components as required to accommodate the additional new devices indicated on the plan drawings.
- C. Keypads
 - 1. The keypad shall be 2-line, 32-character, LCD, Honeywell Systems Keypad FA550KP, or match existing type and model on campus.
- D. System Accessories (provide as required)
 - 1. POPIT Modules
 - 2. Eight Point Expander
 - 3. Addressable Expansion Module
 - 4. Four relay module
 - 5. Supervised relay module
 - 6. Power Supply
 - 7. LAN Network communication module

8. Cellular communication module

E. Intrusion Detecting Devices

1. Motion Detector - Typical Classroom shall be multiplex addressable PIR Honeywell First Alert model 4278EX-SN or match existing type on campus. Locate in room corner. Refer to floor plans for locations.
2. Door Contacts –
 - a. Exterior Steel Doors: recessed dual pole dual throw door contacts, DMP 1076D or equal.
 - b. Rollup/Overhead Door: DMP 2205A or equal
 - c. Roof Hatches: Provide door contacts at all roof hatches whether or not noted on the plan drawings.

F. Remote Power Supply

1. Remote supply for passive infrared motion detectors. Power and voltage per the motion detector device requirements. Quantity as required. Provide power supply, terminal cabinet, transformer and battery as required for a complete and operable system.

G. Wiring

1. The contractor shall provide cables consistent with the manufacturer's recommendations. The following general guidelines shall be followed for wiring installation:
 - a. Wiring shall be appropriately color-coded with permanent wire markers. Copper conductors shall be used.
 - b. All signal cables provided under this contract shall be Class II, plenum-rated cable where required. Where subject to mechanical damage, wiring shall be enclosed in metal conduits or surface metallic raceway.
 - c. Data wires shall not be enclosed in conduit or raceways containing AC power wires.
 - d. Where EMI may interfere with the proper operation of the IDS circuits, twisted/shielded cable shall be used.

2.4 EXAMINATION

- A. Examine areas to receive devices and notify adverse conditions affecting installation or subsequent operation.
- B. Do not begin installation until unacceptable conditions are corrected.
- C. If preparation is the responsibility of another installer, notify architect of unsatisfactory preparation before proceeding.

- D. Ensure selected location is secure and offers protection from accidental damage.
- E. Location shall provide reasonable temperature and humidity conditions, free from sources of electrical and electromagnetic interference.
- F. Ensure power source is protected against accidental shutoff.
- G. Install all equipment and materials in accordance with the "current" recommendations of the manufacturer. The work shall also be in accordance with:
 - 1. Installation criteria defined in these specifications and in the construction documents.
 - 2. Approved submittals.
 - 3. Applicable requirements of referenced standards.
- H. The contractor shall provide the following services as part of the contract:
 - 1. Supervision of sub-contractors.
 - 2. Coordination of other contractors for system-related work (electrical contractor, finish hardware contractor, architect, and general contractor).
 - 3. Attending site construction/coordination meetings.
 - 4. Keeping updated construction drawings at the construction site.
 - 5. Meeting construction deadlines per the construction schedule.
- I. Programming of the system shall include the following tasks:
 - 1. Programming system configuration parameters (hardware and software, zone/circuit numbers, communication parameters).
 - 2. Programming operational parameters such as opening/closing reports and windows, system response text (custom English) displays of events, activation of relays that drive auxiliary devices, and identifying types of zones/loops.
 - 3. Programming passcodes according to the authorities and functions defined by the owner.
 - 4. Other system programming tasks required by the owner. These additional programming requirements shall be coordinated between the owner and the contractor. Testing Wireless system for stability of communications and testing for "dead" spots.
 - 5. Operational Testing: The contractor shall perform thorough operational testing and verify that all system components are fully operational.
 - 6. Hard-copy System Printout and Electronic File. The contractor shall submit a hard-copy system printout and an electronic file with software to read the file of all

components tested and certify 100 percent operation indicating all devices/panels/units have passed the test criteria set forth by the manufacturer.

7. Acceptance Test Plan Form: An acceptance test plan form shall be prepared / provided by the contractor prior to the acceptance walk-through.
8. This form shall include separate sections for each device/panel/unit as well as a column indicating the manufacturer's performance allowance/margin, a column indicating the result of the testing performed by the contractor (pass/fail), and an empty column for recording findings during the walkthrough.
- J. The contractor shall certify completion in writing and schedule the commissioning walk-through. The contractor shall provide all the tools and personnel needed to conduct an efficient commissioning process.

2.5 TRAINING REQUIREMENTS

- A. Installing contractor shall provide a minimum of two (2) hours of hands-on training to the District's staff. Contractor shall coordinate training schedule with District.

2.6 FIELD QUALITY CONTROL

- A. Installation contractor shall submit a written test report that the system has been 100% tested and approved. Final test shall be witnessed by the owner, engineer, electrical contractor, chief security officer, and performed by the installation contractor. Final test report shall be received and acknowledged by the owner prior to request for final payment.
- B. Provide instruction to the owner's satisfaction with regard to proper use and operation of the system.
- C. Determine and report all problems to the manufacturer's customer service department.

2.7 ADJUSTING

- A. System maintenance and repair of system or workmanship defects during the warranty period shall be provided by the Contractor free of charge (parts and labor).
- B. The installer shall correct any system defect within six (6) hours of receipt of call from the Owner.

2.8 DEMONSTRATION

- A. Demonstrate at final inspection that surveillance system and devices functions properly. The Contractor upon completion of installation shall furnish training in the complete operation of the systems.

END OF SECTION

SECTION 28 31 11

FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. A new intelligent reporting, microprocessor controlled fire and gas detection system shall be installed in accordance to the project specifications and drawings.
- B. The work under this section includes all final design, all labor, material, equipment, supplies, labor, testing, and accessories required to furnish and install a complete Fire Alarm System as indicated on the drawings and as specified herein.
- C. All miscellaneous system components including, but not limited to, cables, termination equipment, punch blocks, patch panels, backboards, and any other related items shall be furnished and installed complete under this section, such that the system shall perform all functions listed herein in compliance with all of the specified requirements.
- D. The Fire Alarm System shall include, but not limited to, the following subsystems / products:
 - 1. See Products Section.
- E. Basic Performance:
 - 1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on NFPA Style 4 (Class B) Signaling Line Circuits (SLC).
 - 2. Device Circuits (IDC) shall be wired Class A (NFPA Style D) as part of an addressable device connected by the SLC Circuit.
 - 3. Notification Appliance Circuits (NAC) shall be wired Class A (NFPA Style Z) as part of an addressable device connected by the SLC Circuit.
 - 4. On Style 6 or 7 (Class A) configurations a single ground fault or open circuit on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
 - 5. Alarm signals arriving at the FACP shall not be lost following a primary power failure (or outage) until the alarm signal is processed and recorded.
 - 6. Speaker circuits may be controlled by NAC outputs built into the amplifiers, which shall function as addressable points on the Digital Audio Loop.
 - 7. NAC speaker circuits shall be arranged such that there is a minimum of one speaker circuit per floor of the building or smoke zone whichever is greater.

8. Audio amplifiers and tone generating equipment shall be electrically supervised for normal and abnormal conditions.
9. NAC speaker circuits and control equipment shall be arranged such that loss of any one (1) speaker circuit will not cause the loss of any other speaker circuit in the system. Two-way emergency telephone communication circuits shall be supervised for open and short circuit conditions. Speaker circuits shall be arranged such that there is a minimum of one speaker circuit per smoke zone.
Speaker circuits shall be electrically supervised for open and short circuit conditions. If a short circuit exists on a speaker circuit, it shall not be possible to activate that circuit.
10. Audio amplifiers and tone generating equipment shall be electrically supervised for abnormal conditions. Digital amplifiers shall provide built-in speaker circuits, field configurable as four Class B (Style Y), or two Class A (Style Z) circuits.
11. Digital amplifiers shall be capable of storing up to two minutes of digitally recorded audio messages and tones. The digital amplifiers shall also be capable of supervising the connection to the associated digital message generator, and upon loss of that connection shall be capable of one of the following system responses:
 - a. The digital amplifier shall automatically broadcast the stored audio message.
 - b. The digital amplifier shall switch to a mode where a local bus input on the digital amplifier will accept an input to initiate a broadcast of the stored message. This bus input shall be connected to a NAC on a local FACP for the purpose of providing an alternate means of initiating an emergency message during a communication fault condition.
 - c. Speaker circuits shall be either 25 VRMS or 70VRMS. Speaker circuits shall have 20% space capacity for future expansion or increased power output requirements.
 - d. Two-way emergency telephone (Fire Fighter Telephone) communication shall be supported between the Audio Command Center and up to seven (7) remote Fire Fighter's Telephone locations simultaneously on a telephone riser.
 - e. Means shall be provided to connect FFT voice communications to the speaker circuits in order to allow voice paging over the speaker circuit from a telephone handset.
 - f. The digital audio message generator shall be of reliable, non-moving parts, and support the digital storage of up to 32 minutes of tones and emergency messages, shall support programming options to string audio segments together to create up to 1000 messages, or to loop messages and parts of messages to repeat for pre-determined cycles or indefinitely.

1.2 RELATED WORK

- A. Documents affecting work of this section include, but are not necessarily limited to, General Conditions, Supplementary Conditions and sections of Divisions 1 and 28 of these specifications.
- B. All applicable portions of Section 26 00 00 shall apply to this section as though written herein completely.

1.3 GENERAL REQUIREMENTS

- A. The contractor shall hold a valid State of California C-10 Low-Voltage license, shall have completed at least 20 projects of equal scope, shall have been in business of furnishing and installing systems of this scope and magnitude for at least five years, and capable of being bonded to assure the owner of performance and satisfactory service during the guarantee period.
- B. The contractor shall hold all other licenses required by the legally constituted authorities having jurisdiction over the work.
- C. All work shall be performed under the supervision of a company accredited by the basic equipment manufacturer and such accreditation must be presented.
- D. The installing contractor shall be a factory authorized distributor and warrantee station for the brand of equipment offered and shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment. The installing contractor shall maintain a spare set of all major parts for the system at all times. All circuit boards, amplifiers and control sub systems shall be 100% backed up with stock at contractors shop.
- E. All of the equipment in this specification shall be furnished and installed by the Authorized Factory Distributor of the equipment. The Contractor shall furnish a letter from the manufacturer of all major equipment, which certifies that the installing contractor is the Authorized Distributor and that the equipment has been installed according to factory intended practices. The Contractor shall also furnish a written guarantee from the manufacturer that they will have a service representative assigned to this area for the life of the equipment.
- F. The fire alarm contractor shall be UL listed company under the UL classification of (UUJS). The installation company shall UL certify this installation.
- G. The fire alarm contractor shall have a NICET Certified and Technicians on staff in their facility directly involved with this project to ensure technical expertise to this project and adherence with these specifications.
- H. The fire alarm contractor shall maintain sufficient stock on hand and have a fully equipped service organization capable of guaranteeing response time within 8 hours of service calls, 24 hours a day, 7 days a week to service completed systems.

- I. Equipment, wire and materials shall only be installed by the fire alarm contractor / manufacture's distributor. A Contractor other than the manufacturer's distributor used to install the system is not acceptable.
- J. The fire alarm contractor/distributor shall provide, install and test all equipment related to this section.

1.4 QUALITY ASSURANCE

- A. In order to maintain a high degree of quality assurance, the contractor shall, without exception, use the parts and supplies as specified in this specification.
- B. The system provided shall be manufactured by Siemens. No substitution will be accepted, this is a District standard product.
- C. It is the intent of these specifications to establish a standard of quality for labor and material to be installed. The Base Bid shall include materials as specified - without exception. No substitutions will be accepted.
- D. All of the equipment in this specification shall be furnished and installed by the Authorized Factory Distributor of the equipment with the most current software package available at the time of installation. At the time of Owner Acceptance of the installation, all equipment shall include any and all updated software revisions. In addition, when the software is available in disk format, a backup copy of the most up to date revision, in disk format, shall be handed to the Owner at the completion of the project.
- E. Conform to all of the applicable provisions of the following standards.
 - 1. NFPA 72 – National Fire Alarm Code with California Amendments
 - 2. CBC – California Building Code
 - 3. CEC – California Electrical Code
 - 4. CFC – California Fire Code
 - 5. Local and State Building Codes.
 - 6. All requirements of the Authority Having Jurisdiction (AHJ).

1.5 SUBMITTAL AND MANUAL

- A. Comply with all requirements of the General Conditions, Supplementary Conditions and applicable sections of Divisions 1 and 16 of these specifications.
- B. Additional requirements of this section are:
 - 1. Within thirty-five (35) calendar days after the date of award of the Contract, the Contractor shall submit eight copies of the complete submission to the Architect for review.

2. The submission shall consist of five major sections with each section separated with index tabs. Each page in the submission shall be numbered chronologically and shall be summarized in the index.
3. The first section shall be the "index" which shall include the project title and address, name of the firm submitting the proposal and name of the Architect.
4. The second section shall include the following items:
 - a. Contractor's License: A copy of the electronics contractor's valid State of California License.
 - b. Proof of Experience: Proof that the fire alarm contractor has been regularly engaged in the business of fire alarm contracting consisting of, but not limited to, engineering, fabrication, installation, and servicing of fire alarm systems of the type specified herein for at least the past ten (10) consecutive years. Provide a statement summarizing any pending litigation involving any officer or principal of/or the company, the nature of the litigation and what effect the litigation may carry as it relates to this work in the worst case scenario. Non-disclosure of this item, if later discovered, may result, at the owner's discretion, in the contractor bearing all costs and any cost related to associated delays in the progress of the work.
 - c. Insurance Certificates: Copy of fire alarm contractor's current liability insurance and state industrial insurance certificates in conformance with the contract documents.
 - d. Project List: A List containing at least ten (10) California installations completed within the last five (5) years by the fire alarm contractor that are comparable in scope and nature to that specified in the contract document.
 - e. Service Capability: Documentation indicating in detail that the fire alarm contractor has competent engineering, installation, service personnel and facilities with reasonable stock of service parts within 100 air miles of the job site.
 - f. Authorization Letters: Letters from the fire alarm equipment manufacturer stating that the fire alarm contractor is the Factory Authorized Distributor, and is trained and certified for the equipment he proposes to use on this project, and is licensed to purchase and install that software required to provide the specified functions.
 - g. Certification:
 - 1) Proof that the fire alarm contractor is Underwriters Laboratories, Inc. (UL) listed under the classification of "PROTECTIVE SIGNALING SERVICES-LOCAL, AUXILIARY, REMOTE STATION AND PROPRIETARY (UUJS).

- 2) Copy of the following: (NICET) Certificates. Provide proof that the certificate holders are a part of the fire alarm contractor's local facility servicing this project and will be actively involved in this project.
 - a) Technician Level 2 minimum of (5).
 - b) Technician Level 4 minimum of (1)
- h. Proof of Trained Personnel:
 - 1) Documentation that the fire alarm contractor has on staff personnel factory-trained and certified for the equipment proposed for this project. Also, provide a statement that personnel meeting these qualifications are in the local facility, and will be maintained at that facility throughout the project and the warranty period.
5. The third section shall contain the comparative specification listing, including a complete listing of the characteristics of the equipment to be furnished next to all of the specified equipment's features and functions as stated in the specifications and data sheets. Include CSFM listing sheet for each component.
6. The fourth section shall contain an original factory data sheet for every component in the specifications.
7. The fifth section shall contain a designation schedule for each Structured Cabling System location and complete 1/8" = 1'-0" scale drawing showing system wiring plans.
 - a. Riser Diagram.
 - b. Typical Device Wiring Diagram.
 - c. Wire Legend, including types for zones and devices and color coding to be utilized.
 - d. Battery Calculation for each control panel, power supply, field power supply and network annunciator.
 - e. Worst Case Voltage drop for each circuit type per building.
 - f. Floor Plans showing all conduits, sizes, quantity of conductors.
 - g. Mounting Height of each devices and back box requirement.
 - h. Zoning and address description legend.
- C. Failure to comply with all of the requirements listed above will result in the rejection of the entire submittal package.
- D. The Contractor shall provide two copies of an "Operating and Servicing Manual" for the system. The manuals shall be bound in flexible binders. All data shall be printed material or typewritten. Each manual shall include the following: Instructions

necessary for the proper operation and servicing of the system; complete as-built installation drawings of the system; a wiring destination schedule for each circuit leaving for each piece of equipment; a schematic diagram of major components with all transistor and IC complements and replacement number.

1.6 GENERAL SYSTEM PRODUCT, INSTALLATION AND OVERALL SYSTEM WARRANTY

- A. Prior to Owner acceptance, the contractor shall provide to Owner, a manufacturers product and performance warranty. This will require a submittal of the required pre-job certification registration forms as well as the required project closing information. The Owner will only acknowledge acceptance upon submittal of a valid manufacturer's warranty.
- B. The warranty shall commence from the date of final written acceptance by the Owner.
- C. All conditions for obtaining the manufacturers warranty shall be the sole responsibility of the contractor.
- D. The contractor shall maintain a competent service organization and shall, if requested, submit a service maintenance agreement to the owner after the end of the guarantee period.
- E. A typewritten notice shall be posted at the equipment rack that shall indicate the firm, address and telephone number to call when service is necessary. The notice shall be mounted in a neatly finished metal frame with a clear plastic window and securely attached to the inside of the door.

1.7 SPECIFIC SYSTEM PRODUCT, INSTALLATION AND OVERALL SYSTEM WARRANTY

- A. The entire system shall be warranted free of mechanical or electrical defects for a period of one (1) year after final acceptance of the installation. Any material showing mechanical or electrical defects shall be replaced promptly at no expense to the Owner.

1.8 DESCRIPTION

- A. The fire alarm system shall comply with requirements of NFPA Standard 72 for Protected Premises Signaling Systems except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.
- B. The facility shall have an emergency voice alarm communication system. Digitally stored message sequences shall notify the building occupants that a fire or life safety condition has been reported. Message generator(s) shall be capable of automatically distributing up to eight (8) simultaneous, unique messages to appropriate audio zones within the facility based on the type and location of the initiating event. The Fire Command Center (FCC) shall also support Emergency manual voice announcement capability for both system wide or selected audio zones, and shall

include provisions for the system operator to override automatic messages system wide or in selected zones.

- C. The system shall be support additional, alternate Fire Command Centers, which shall be capable of simultaneous monitoring of all system events. Alternate Fire Command Centers shall also support an approved method of transferring the control functions to an alternate Fire Command Center when necessary. All Fire Command Centers shall be individually capable of assuming Audio Command functions such as Emergency Paging, audio zone control functions, and Firefighter's Telephone communication functions.
- D. Each designated zone shall transmit separate and different alarm, supervisory and trouble signals to the Fire Command Center (FCC) and designated personnel in other buildings at the site via a multiplex communication network.
- E. The fire alarm system shall be manufactured by an ISO 9001:2008 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994
- F. The FACP and peripheral devices shall be manufactured 100% by a single U.S. manufacturer (or division thereof). It's acceptable for peripheral devices to be manufactured outside of the U.S. by a division of the U.S. based parent company.
- G. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.
- H. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final checkout and to ensure the systems integrity.

1.9 POST CONTRACT MAINTENANCE:

- A. Complete maintenance and repair service for the fire and gas detection system shall be available from a factory trained authorized representative of the manufacturer of the major equipment for a period of five (5) years after expiration of the guaranty.
- B. As part of the bid/proposal, include a quote for a maintenance contract to provide all maintenance, required tests, and list pricing for any replacement products included on the bill of materials, along with the list pricing for products not on the bill of materials; if test and inspection rates are different than full service rates the bid/proposal shall include pricing for all levels for a minimum period of five (5) years Rates and costs shall be valid for the period of five (5) years after expiration of the guaranty.
- C. Include also a quote for unscheduled maintenance/repairs, including hourly rates for technicians trained on this equipment, and response travel costs for each year of the maintenance period. Submittals that do not identify all post contract maintenance costs will not be accepted. Rates and costs shall be valid for the period of five (5) years after expiration of the guaranty.
- D. As part of the submittal, include a quotation for all parts and material, and all installation and test labor as needed to increase the number of intelligent or

addressable devices by ten percent (10%). This quotation shall include intelligent smoke detectors, intelligent heat detectors, addressable manual stations, addressable monitor modules and addressable modules equal in number to one tenth of the number required to meet this specification (list actual quantity of each type).

- E. The quotation shall include installation, test labor, and labor to reprogram the system for this 10% expansion. If additional FACP hardware is required, include the material and labor necessary to install this hardware.
- F. Do not include cost of conduit or wire or the cost to install conduit or wire except for labor to make final connections at the FACP and at each intelligent addressable device. Do not include the cost of conventional peripherals or the cost of initiating devices or notification appliances connected to the addressable monitor/control modules.
- G. Submittals that do not include this estimate of post contract expansion cost will not be accepted.

PART 2 - PRODUCTS

2.1 MAIN FIRE ALARM CONTROL PANEL OR NETWORK NODE:

- A. Main FACP or network node shall be by Siemens and shall contain a microprocessor based Central Processing Unit (CPU) and power supply. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, and other system controlled devices.
- B. In conjunction with intelligent Loop Control Modules and Loop Expander Modules, the main FACP shall perform the following functions:
 - 1. Supervise and monitor all intelligent addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.
 - 2. Supervise all initiating signaling and notification circuits throughout the facility by way of connection to addressable monitor and control modules.
 - 3. Detect the activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed. In the event of CPU failure, all SLC loop modules shall fallback to degrade mode. Such degrade mode shall treat the corresponding SLC loop control modules and associated detection devices as conventional two-wire operation. Any activation of a detector in this mode shall automatically activate associated Notification Appliance Circuits.

2.2 SYSTEM CAPACITY AND GENERAL OPERATION

- A. The FACP shall be capable of communicating on a Local Area Network (LAN) or Wide Area Network (WAN) utilizing a peer-to-peer, inherently regenerative communication format and protocol. The network shall support communication speed up to 100 Mb and support up to 200 panels / nodes per network.

- B. The control panel shall be capable of expansion via up to 10 SLC loops. Each module shall support up to 318 analog/addressable devices for a maximum system capacity of 3180 points. The Fire Alarm Control Panel shall include a full featured operator interface control and annunciation panel that shall include a backlit 640-character liquid crystal display, individual, color coded system status LEDs, and a QWERTY style alphanumeric keypad for the field programming and control of the fire alarm system. Said LCD shall also support graphic bit maps.e owner or installing com
- C. All programming or editing of thmning or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the fire alarm control panel.
- D. The FACP shall be able to provide the following software and hardware features:
 - 1. Pre-signal and Positive Alarm Sequence: The system shall provide means to cause alarm signals to only sound in specific areas with a delay of the alarm from 60 to up to 180 seconds after start of alarm processing. In addition, a Positive Alarm Sequence selection shall be available that allows a 15-second time period for acknowledging an alarm signal from a fire detection/initiating device. If the alarm is not acknowledged within 15 seconds, all local and remote outputs shall automatically activate immediately.
 - 2. Smoke Detector Pre-alarm Indication at Control Panel: To obtain early warning of incipient or potential fire conditions, the system shall support a programmable option to determine system response to real-time detector sensing values above the programmed setting. Two levels of Pre-alarm indication shall be available at the control panel: alert and action.
 - 3. Alert: It shall be possible to set individual smoke detectors for pre-programmed pre-alarm thresholds. If the individual threshold is reached, the pre-alarm condition shall be activated.
 - 4. Action: If programmed for Action and the detector reaches a level exceeding the pre-programmed level, the control panel shall indicate an action condition. Sounder bases installed with either heat or smoke detectors shall automatically activate on action Pre-Alarm level, with general evacuation on Alarm level.
 - 5. The system shall support a detector response time to meet world annunciation requirements of less than 3 seconds.
 - 6. Device Blink Control: Means shall be provided to turn off detector/module LED strobes for special areas.
 - 7. NFPA 72 Smoke Detector Sensitivity Test: The system shall provide an automatic smoke detector test function that meets the sensitivity testing requirements of NFPA 72.
 - 8. Programmable Trouble Reminder: The system shall provide means to automatically initiate a reminder that troubles exist in the system. The remainder will appear on the system display and (if enabled) will sound a piezo alarm.

9. On-line or Off-line programming: The system shall provide means to allow panel programming either through an off-line software utility program away from the panel or while connected and on-line. The system shall also support upload and download of programmed database and panel executive system program to a Personal Computer/laptop. A single change to one CPU database shall not require a database download to other CPUs.
10. History Events: The panel shall maintain a history file of the last 4000 events, each with a time and date stamp. History events shall include all alarms, troubles, operator actions, and programming entries. The control panels shall also maintain a 1000 event Alarm History buffer, which consists of the 1000 most recent alarm events from the 4000 event history file.
11. Smoke Control Modes: The system shall provide means to perform FSCS mode Smoke Control to meet NFPA-92A and 90B and HVAC mode to meet NFPA 90A.
12. The system shall provide means for all SLC devices on any SLC loop to be auto programmed into the system by specific address. The system shall recognize specific device type ID's and associate that ID with the corresponding address of the device.
13. Passwords and Users: The system shall support two password levels, master and user. Up to 9 user passwords shall be available, each of which may be assigned access to the programming change menus, the alter status menus, or both. Only the master password shall allow access to password change screens.
14. Block Acknowledge: The system shall support a block Acknowledge for Trouble Conditions
15. Sensitivity Adjust: The system shall provide Automatic Detector Sensitivity Adjust based on Occupancy schedules including a Holiday list of up to 15 days.
16. Environmental Drift Control: The system shall provide means for setting Environmental Drift Compensation by device. When a detector accumulates dust in the chamber and reaches an unacceptable level but yet still below the allowed limit, the control panel shall indicate a maintenance alert warning. When the detector accumulates dust in the chamber above the allowed limit, the control panel shall indicate a maintenance urgent warning.
17. Custom Action Messages: The system shall provide means to enter up to 100 custom action messages of up to 160 characters each. It shall be possible to assign any of the 100 messages to any point.
18. Local Mode: If communication is lost to the central processor the system shall provide added survivability through the intelligent loop control modules. Inputs from devices connected to the SLC and loop control modules shall activate outputs on the same loop when the inputs and outputs have been set with point programming to participate in local mode or when the type codes are of the same type: that is, an input with a fire alarm type code shall activate an output with a fire alarm type code.

19. Read status preview - enabled and disabled points: Prior to re-enabling points, the system shall inform the user that a disabled device is in the alarm state. This shall provide notice that the device must be reset before the device is enabled thereby avoiding activation of the notification circuits.
20. Custom Graphics: When fitted with an LCD display, the panel shall permit uploading of a custom bit-mapped graphic to the display screen.
21. Multi-Detector and Cooperating Detectors: The system shall provide means to link one detector with up to two detectors at other addresses on the same loop in cooperative multi-detector sensing. There shall be no requirement for sequential addresses on the detectors and the alarm event shall be a result of all cooperating detectors chamber readings.
22. ACTIVE EVENT: The system shall provide a Type ID for purposes of air-handling shutdown, which shall be intended to override normal operating automatic functions. Activation of a point shall cause the control panel to (1) initiate the monitor module Control-by-Event, (2) send a message to the panel display, history buffer, installed printer and annunciators, (3) shall not light an indicator at the control panel, (4) Shall display ACTIVE on the LCD as well a display a code and other information specific to the device.
23. NON-FIRE Alarm Module Reporting: A point with a type ID of NON-FIRE shall be available for use for energy management or other non-fire situations. NON-FIRE point operation shall not affect control panel operation nor shall it display a message at the panel LDC. Activation of a NON-FIRE point shall activate control by event logic but shall not cause any indication on the control panel.
24. Mass Notification Override: The system shall be UL 2572 listed for Mass Notification and shall be capable, based on the Risk Analysis, of being programmed so that Mass Notification/Emergency Communications events take precedence over fire alarm events.
25. Security Monitor Points: The system shall provide means to monitor any point as a type security.
26. One-Man Walk Test: The system shall provide both a basic and advanced walk test for testing the entire fire alarm system. The basic walk test shall allow a single operator to run audible tests on the panel. All logic equation automation shall be suspended during the test and while annunciators can be enabled for the test, all shall default to the disabled state. During an advanced walk test, field-supplied output point programming will react to input stimuli such as CBE and logic equations. When points are activated in advanced test mode, each initiating event shall latch the input. The advanced test shall be audible and shall be used for pull station verification, magnet activated tests on input devices, input and output device and wiring operation/verification.
27. Control By Event Functions: CBE software functions shall provide means to program a variety of output responses based on various initiating events. The control panel shall operate CBE through lists of zones. A zone shall become listed when it is added to a point's zone map through point programming. Each

input point such as detector, monitor module or panel circuit module shall support listing of up to 10 zones into its programmed zone map.

28. Permitted zone types shall be general zone, releasing zone and special zone. Each output point (control module, panel circuit module) can support a list of up to 10 zones including general zone, logic zone, releasing zone and trouble zone. It shall be possible for output points to be assigned to list general alarm. Non-Alarm or Supervisory points shall not activate the general alarm zone.
29. 1000 General Zones: The system shall support up to 1000 general purpose software zones for linking inputs to outputs. When an input device activates, any general zone programmed into that device's zone map will be active and any output device that has an active general zone in its map will be active. It shall also be possible to use general zone as arguments in logic equations.
30. 1000 Logic Equations: The system shall support up to 1000 logic equations for AND, OR, NOT, ONLY1, ANYX, XZONE or RANGE operators that allow conditional I/O linking. When any logic equation becomes true, all output points mapped to the logic zone shall activate.
31. 100 trouble equations per device: The system shall provide support for up to 100 trouble equations for each device, which shall permit programming parameters to be altered, based on specific fault conditions. If the trouble equation becomes true, all output points mapped to the trouble zone shall activate.
32. Control-By-Time: A time based logic function shall be available to delay an action for a specific period of time based upon a logic input with tracking feature. A latched version shall also be available. Another version of this shall permit activation on specific days of the week or year with ability to set and restore based on a 24 hour time schedule on any day of the week or year.
33. Multiple agent releasing zones: The system shall support up to 10 releasing zones to protect against 10 independent hazards. Releasing zones shall provide up to three cross-zone and four abort options to satisfy any local jurisdiction requirements.
34. Alarm Verification, by device, with timer and tally: The system shall provide a user-defined global software timer function that can be set for a specific detector. The timer function shall delay an alarm signal for a user-specified time period and the control panel shall ignore the alarm verification timer if another alarm is detected during the verification period. It shall also be possible to set a maximum verification count between 0 and 20 with the "0" setting producing no alarm verification. When the counter exceeds the threshold value entered, a trouble shall be generated to the panel.
 - a. Secure/Access Operation: The system shall have the capability of configuring input modules to monitor status of door contact or other security type sensors. These input modules shall be able to be commanded from the normally 'Secure' state to an 'Access' state. While in the secure state, the module will transmit alarm conditions to the controller, which shall be annunciated on the LCD and LED displays. The modules shall be placed into

the Access state either through the LCD display or through predefined operator keys. While in the Access state, all alarms from the module will be shunted. Placing the module into the access state shall cause a discrete LED associated with input point to flash, but no other trouble or disable condition will be annunciated. Change from Secure to Access and reverse shall be transmitted to the central monitoring station on a per zone basis. Systems that cause or indicate a trouble or disable condition are unacceptable.

E. Network Communication

1. The FACP shall be capable of communicating over a Local Area Network (LAN) or Wide Area Network (WAN) utilizing a peer-to-peer, inherently regenerative communication format and protocol. The network shall support communication speed up to 100 Mb and support up to 200 panels/nodes per network.

F. The FACP shall be capable of communicating with a Distributed Control System Central Processing Unit

1. The Central Processing Unit shall contain and execute all control-by-event (including Boolean functions including but not limited to AND, OR, NOT, ANYx, and CROSSZONE) programs for specific action to be taken if an alarm condition is detected by the system. Such control-by-event programs shall be held in non-volatile programmable memory, and shall not be lost with system primary and secondary power failure.
2. The Central Processing Unit shall also provide a real-time clock for time annotation, to the second, of all system events. The time-of-day and date shall not be lost if system primary and secondary power supplies fail.
3. The CPU shall be capable of being programmed on site without requiring the use of any external programming equipment. Systems that require the use of external programmers or change of EPROMs are not acceptable.
4. The CPU shall provide an EIA-232 interface between the fire alarm control panel and the UL Listed Electronic Data Processing (EDP) peripherals.
5. The CPU shall provide two EIA-485 ports for the serial connection to annunciation and control subsystem components.
6. The EIA-232 serial output circuit shall be optically isolated to assure protection from earth ground.

G. Display

1. The system display shall provide a 640-character backlit alphanumeric Liquid Crystal Display (LCD). It shall also provide eleven Light-Emitting-Diodes (LEDs) that indicate the status of the following system parameters: AC POWER, FIRE ALARM, PREALARM, SECURITY, SUPERVISORY, SYSTEM TROUBLE, OTHER EVENT, SIGNALS SILENCED, POINT DISABLED, CONTROLS ACTIVE, and CPU FAILURE.

2. The system display shall provide a QWERTY style keypad with control capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels with up to ten (one Master and nine User) passwords shall be accessible through the display interface assembly to prevent unauthorized system control or programming.

H. Loop (Signaling Line Circuit) Control Module:

1. The Loop Control Module shall monitor and control a minimum of 318254318 intelligent addressable devices. This includes 159 159127 intelligent detectors (Ionization, Photoelectric, or Thermal) and 159127159monitor or control modules.
2. The Loop Control Module shall contain its own microprocessor and shall be capable of operating in a local/degrade mode (any addressable device input shall be capable of activating any or all addressable device outputs) in the unlikely event of a failure in the main CPU.
3. Each Loop shall be capable of operating as a NFPA Style 4 (Class B) circuit. Fault isolation modules shall be installed between each addressable SLC device per the manufacturers installation instructions. Systems which cannot provide full loop loading in Style 7 configurations are not acceptable.
4. The SLC interface board shall receive analog or digital information from all intelligent detectors and shall process this information to determine whether normal, alarm, or trouble conditions exist for that particular device. Each SLC Loop shall be isolated and equipped to annunciate an Earth Fault condition. The SLC interface board software shall include software to automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information may also be used for automatic detector testing and the automatic determination of detector maintenance requirements.

I. Digital Voice Command Center

1. The Digital Voice Command Center located with the FACP, shall contain all equipment required for all audio control, emergency telephone system control, signaling and supervisory functions. This shall include speaker zone indication and control, telephone circuit indication and control, digital voice units, microphone and main telephone handset.
2. Function: The Voice Command Center equipment shall perform the following functions:
 - a. Operate as a supervised multi-channel emergency voice communication system. Operate as a two-way emergency telephone system control center.
 - b. Audibly and visually annunciate the active or trouble condition of every speaker circuit and emergency telephone circuit.

- c. Audibly and visually annunciate any trouble condition for digital tone and voice units required for normal operation of the system.
- d. Provide all-call Emergency Paging activities through activation of a single control switch.
- e. As required, provide vectored paging control to specific audio zones via dedicated control switches.
- f. Provide a factory recorded "library" of voice messages and tones in standard WAV. File format, which may be edited and saved on a PC running a current Windows® operating system.
- g. Provide a software utility capable of off-line programming for the DVC operation and the audio message files. This utility shall support the creation of new programs as well as editing and saving existing program files. Uploading or downloading the DVC shall not inhibit the emergency operation of other nodes on the fire alarm network.
- h. Support an optional mode of operation with four analog audio outputs capable of being used with UL 864 fire-listed analog audio amplifiers and SLC controlled switching.
- i. The Digital Voice Command shall be modular in construction, and shall be capable of being field programmable without requiring the return of any components to the manufacturer and without requiring use of any external computers or other programming equipment.
- j. The Digital Voice Command and associated equipment shall be protected against unusually high voltage surges or line transients.

J. Power Supply:

- 1. The Main Power Supply shall operate on 120/240 VAC, 50/60 Hz, and shall provide all necessary power for the FACP.
- 2. The Main Power Supply shall provide the required power to the CPU using a switching 24 VDC regulator and shall incorporate a battery charger for 24 hours of standby power using dual-rate charging techniques for fast battery recharge.
- 3. The Main Power Supply shall provide a battery charger for 24 hours of standby using dual-rate charging techniques for fast battery recharge. The supply shall be capable of charging batteries ranging in capacity from 7-200 amp-hours within a 48-hour period.
- 4. The Main Power Supply shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults.
- 5. The Main Power Supply shall be power-limited per UL864 requirements.

6. The Main Power Supply shall communicate power supply, line voltage, battery status and charger status to the local LCD display. Any abnormal condition shall be annunciated and logged to the system alarm history log.
7. Addressable Charger Power Supply: The auxiliary addressable power supply is a remote 24 VDC power supply used to power Notification Devices and field devices that require regulated 24 VDC power.
8. The addressable power supply for the fire and gas detection system shall provide up to a minimum of 6.0 amps of 24 volt DC regulated power for Notification Appliance Circuit (NAC) power or 10.0 amps of 24 volt DC general power. The power supply shall have an additional 0.5 amp of 24 VDC auxiliary power for use within the same cabinet as the power supply. It shall include an integral charger designed to charge 12 - 200 amp hour batteries.
9. The addressable power supply shall provide four individually addressable Notification Appliance Circuits that may be configured as Class "A" or Class "B" circuits. All circuits shall be power-limited per UL 864 requirements.
10. The addressable power supply shall provide built-in synchronization for certain Notification Appliances on each circuit without the need for additional synchronization modules. The power supply's output circuits shall be individually selected for synchronization. A single addressable power supply shall be capable of supporting both synchronized and non-synchronized Notification Devices at the same time.
11. The addressable power supply shall operate on 120 or 240 VAC, 50/60 Hz.
12. The interface to the power supply from the Fire Alarm Control Panel (FACP) shall be via the Signaling Line Circuit (SLC) or other multiplexed means. Power supplies that do not use an intelligent interface are not suitable substitutes. The required wiring from the FACP to the addressable power supply shall be a single unshielded twisted pair wire.
13. The addressable power supply shall supervise for battery charging failure, AC power loss, power brownout, battery failure, NAC loss, and optional ground fault detection. In the event of a trouble condition, the addressable power supply shall report the incident and the applicable address to the FACP via the SLC.
14. The addressable power supply shall have an AC Power Loss Delay option. If this option is utilized and the addressable power supply experiences an AC power loss, reporting of the incident to the FACP will be delayed. A delay time of zero, two, eight or sixteen hours shall be programmable.
15. The addressable power supply shall have an option for Canadian Trouble Reporting and this option shall be programmable.
16. The addressable power supply mounts in either the FACP backbox or its own dedicated surface mounted backbox with cover.

17. Each of the power supply's four output circuits shall be programmed- for Notification Appliance Circuit or General Purpose 24 VDC power. Any output circuit shall be able to provide up to 2.5 amps of 24 VDC power.
18. The addressable power supply's output circuits shall be individually supervised when they are selected to be either a Notification Appliance Circuit when wired Class "A" or by the use of an end-of-line resistor. When the power supply's output circuit is selected as General 24 VDC power, the circuit shall be individually supervised when an end-of-line relay is used.
19. When selected for Notification Appliance Circuits, the output circuits shall be individually programmable for Steady, March Time, Dual Stage or Temporal.
20. When selected as a Notification Appliance Circuit, the output circuits of the addressable power supply shall have the option to be coded by the use of a universal zone coder.
21. The addressable power supply shall interface and synchronize with other power supplies of the same type. The required wiring to interface multiple addressable power supplies shall be a single unshielded, twisted pair wire.
22. An individual or multiple interfaced addressable power supplies shall have the option to use an external charger for battery charging. Interfaced power supplies shall have the option to share backup battery power.

K. Audio Amplifiers

1. The Audio Amplifiers will provide Audio Power @25 Volts RMS@70 Volts RMS for distribution to speaker circuits.
2. Multiple audio amplifiers may be mounted in a single enclosure, either to supply incremental audio power, or to function as an automatically switched backup amplifier(s).
3. The audio amplifier shall include an integral power supply, and shall provide built-in LED indicators for the following conditions:
 - a. Earth Fault on DAP A (Digital Audio Port A)
 - b. Earth Fault on DAP B (Digital Audio Port B)
 - c. Audio Amplifier Failure Detected Trouble
 - d. Active Alarm Bus input
 - e. Audio Detected on Aux Input A
 - f. Audio Detected on Aux Input B
 - g. Audio Detected on Firefighter's Telephone Riser
 - h. Receiving Audio from digital audio riser

- i. Short circuit on speaker circuit 1
 - j. Short circuit on speaker circuit 2
 - k. Short circuit on speaker circuit 3
 - l. Short circuit on speaker circuit 4
 - m. Data Transmitted on DAP A
 - n. Data Received on DAP A
 - o. Data Transmitted on DAP B
 - p. Data Received on DAP B
 - q. Board failure
 - r. Active fiber optic media connection on port A (fiber optic media applications)
 - s. Active fiber optic media connection on port B (fiber optic media applications)
 - t. Power supply Earth Fault
 - u. Power supply 5V present
 - v. Power supply conditions - Brownout, High Battery, Low Battery, Charger Trouble
4. The audio amplifier shall provide the following built-in controls:
- a. Amplifier Address Selection Switches
 - b. Signal Silence of communication loss annunciation Reset
 - c. Level adjustment for background music
 - d. Enable/Disable for Earth Fault detection on DAP A
 - e. Enable/Disable for Earth Fault detection on DAP A
 - f. Switch for 2-wire/4-wire FFT riser
5. Adjustment of the correct audio level for the amplifier shall not require any special tools or test equipment.
6. Includes audio input and amplified output supervision, back up input, and automatic switch over function, (if primary amplifier should fail).
7. System shall be capable of backing up digital amplifiers.

8. One-to-one backup shall be provided by either a plug-in amplifier card or a designated backup amplifier of identical model as the primary amplifier.
9. One designated backup amplifier shall be capable of backing up multiple primary amplifiers mounted in the same or adjacent cabinets.
10. Multi-channel operation from a single amplifier shall be supported by the addition of an optional plug-in amplifier card.

L. Audio Message Generator (Prerecorded Voice)/Speaker Control:

1. Each initiating zone or intelligent device shall interface with an emergency voice communication system capable of transmitting a prerecorded voice message to all speakers in the building.
2. Actuation of any alarm initiating device shall cause a prerecorded message to sound over the speakers. The message shall be repeated four (4) times. Pre- and post-message tones shall be supported.
3. A built-in microphone shall be provided to allow paging through speaker circuits.
4. System paging from emergency telephone circuits shall be supported.
5. The audio message generator shall have the following indicators and controls to allow for proper operator understanding and control:
 - a. Lamp Test
 - b. Trouble
 - c. Off-Line Trouble
 - d. Microphone Trouble
 - e. Phone Trouble
 - f. Busy/Wait
 - g. Page Inhibited
 - h. Pre/Post Announcement Tone

M. Controls with associated LED Indicators:

1. Speaker Switches/Indicators
 - a. The speaker circuit control switches/indicators shall include visual indication of active and trouble status for each speaker circuit in the system.
 - b. The speaker circuit control panel shall include switches to manually activate or deactivate each speaker circuit in the system.\

2. Emergency Two-Way Telephone Control Switches/Indicators

- a. The emergency telephone circuit control panel shall include visual indication of active and trouble status for each telephone circuit in the system.
- b. The telephone circuit control panel shall include switches to manually activate or deactivate each telephone circuit in the system.

N. Remote Transmissions:

1. Provide local energy or polarity reversal or trip circuits as required.
2. The system shall be capable of operating a polarity reversal or local energy or fire alarm transmitter for automatically transmitting fire information to the fire department.
3. Provide capability and equipment for transmission of zone alarm and trouble signals to remote operator's terminals, system printers and annunciators.
4. Transmitters shall be compatible with the systems and equipment they are connected to such as timing, operation and other required features.

O. Field Programming

1. The system shall be programmable, configurable and expandable in the field without the need for special tools, laptop computers, or other electronic interface equipment. There shall be no firmware changes required to field modify the system time, point information, equations, or annunciator programming/information.
2. It shall be possible to program through the standard FACP keyboard all system functions.
3. All field defined programs shall be stored in non-volatile memory. Two levels of password protection shall be provided in addition to a key-lock cabinet. One level shall be used for status level changes such as point/zone disable or manual on/off commands (Building Manager). A second (higher-level) shall be used for actual change of the life safety program (installer). These passwords shall be five (5) digits at a minimum. Upon entry of an invalid password for the third time within a one minute time period an encrypted number shall be displayed. This number can be used as a reference for determining a forgotten password.
4. The system programming shall be "backed" up via an upload/download program, and stored on compatible removable media. A system back-up disk shall be completed and given in duplicate to the building owner and/or operator upon completion of the final inspection. The program that performs this function shall be "non-proprietary", in that, it shall be possible to forward it to the building owner/operator upon his or her request.
5. The installer's field programming and hardware shall be functionally tested on a computer against known parameters/norms which are established by the FACP

manufacturer. A software program shall test Input-to-Output correlations, device Type ID associations, point associations, time equations, etc. This test shall be performed on an IBM-compatible PC with a verification software package. A report shall be generated of the test results and two copies turned in to the engineer(s) on record.

P. Specific System Operations

1. Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all addressable intelligent detectors in the system from the system keypad. Sensitivity range shall be within the allowed UL window and have a minimum of 9 levels.
2. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification delay shall be programmable from 0 to 60 seconds and each detector shall be able to be selected for verification. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.

Q. System Point Operations:

1. Any addressable device in the system shall have the capability to be enabled or disabled through the system keypad or video terminal.
2. System output points shall be capable of being turned on or off from the system keypad or the video terminal.
3. Point Read: The system shall be able to display the following point status diagnostic functions without the need for peripheral equipment. Each point shall be annunciated for the parameters listed:
 - a. Device Status.
 - b. Device Type.
 - c. Custom Device Label.
 - d. Software Zone Label.
 - e. Device Zone Assignments.
 - f. Analog Detector Sensitivity.
 - g. All Program Parameters.
4. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 4000 system events. Each of these events will be stored, with time and date stamp, until an operator requests that the contents be either displayed or printed. The contents of the

history buffer may be manually reviewed; one event at a time, and the actual number of activations may also be displayed and or printed. History events shall include all alarms, troubles, operator actions, and programming entries.

5. The history buffer shall use non-volatile memory. Systems which use volatile memory for history storage are not acceptable.
6. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent system detector and shall analyze the detector responses over a period of time.
7. If any intelligent detector in the system responds with a reading that is below or above normal limits, then the system will enter the trouble mode, and the particular Intelligent Detector will be annunciated on the system display, and printed on the optional system printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
8. The system shall include the ability (programmable) to indicate a "pre-alarm" condition. This will be used to alert maintenance personal when a detector is at 80% of its alarm threshold in a 60 second period.

R. System Maintenance Analysis and Reporting

1. The system shall automatically track NFPA 72 installation and testing requirements for all addressable devices to ensure that every device is functionally tested upon installation and then periodically as required by the Code.
2. If after twelve months any device has not been functionally tested a led shall illuminate on the CPU or Network annunciator indicating the device that needs testing.
3. The system shall automatically track device testing to ensure that a visual inspection is performed at least semi-annually.
4. If after six months a device has not been indicated as "visually inspected" a led shall illuminate on the CPU or Network annunciator indicating the device that needs testing.
5. A hand-held IR tool may be used to interact with each SLC device to indicate that a visual inspection has been performed. The IR device will explicitly identify the device by loop and address to ensure the correct visual inspection has been performed.
6. A comprehensive report shall be available from the laptop programmer which shows a predictive report of all devices that have upcoming testing requirements. These reports shall be configurable as either 30, 60 or 90 day predictive, current status, and "all database."

7. Systems that do not automatically track the individual testing requirements of the field devices will not be accepted.

2.3 SYSTEM COMPONENTS:

A. Portable Emergency Telephone Handset Jack

1. Portable emergency telephone handset jacks shall be flush mounted on stainless steel plates as indicated on plans. Handset jacks shall be approved for emergency telephone system application.
2. Insertion of a remote handset plug into a jack shall send a signal to the fire command center which shall audibly and visually indicate the on-line condition, and shall sound a ring indication in the handset.
3. The two-way emergency telephone system shall support a minimum of seven (7) handsets on line without degradation of the signal.

B. Fixed Emergency Telephone Handset

1. The telephone cabinet shall be painted red and clearly labeled emergency telephone. The cabinets shall be located where shown on drawings.
2. The handset cradle shall have a switch connection such that lifting the handset off of the cradle shall send a signal to the fire command center which shall audibly and visually indicate its on-line (off-hook) condition.
3. The two-way emergency telephone system shall support a maximum of seven (7) handsets on line (off hook) without degradation of the signal.

C. Universal Digital Alarm Communicator Transmitter (UDACT). The UDACT is an interface for communicating digital information between a fire alarm control panel and an UL-Listed central station.

1. The UDACT shall be compact in size, mounting in a standard module position of the fire alarm control cabinet. Optionally, the UDACT shall have the ability for remote mounting, up to 6,000 feet from the fire alarm control panel. The wire connections between the UDACT and the control panel shall be supervised with one pair for power and one pair for multiplexed communication of overall system status. Systems that utilize relay contact closures are not acceptable.
2. The UDACT shall include connections for dual telephone lines (with voltage detect), per UL/NFPA/FCC requirements. It shall include the ability for split reporting of panel events up to two different telephone numbers.
3. The UDACT shall be capable of transmitting events in 4+2, SIA, and Contact ID.
4. Communication shall include vital system status such as:
 - a. Independent Zone (Alarm, trouble, non-alarm, supervisory)
 - b. Independent Addressable Device Status

- c. AC (Mains) Power Loss
 - d. Low Battery and Earth Fault
 - e. System Off Normal
 - f. 12 and 24 Hour Test Signal
 - g. Abnormal Test Signal (per UL requirements)
 - h. EIA-485 Communications Failure
 - i. Phone Line Failure
- 5. The UDACT shall support independent zone/point reporting when used in the Contact ID format. In this format the UDACT shall support transmission of up to 3,064 points. This enables the central station to have exact details concerning the origin of the fire or response emergency.
 - 6. The UDACT shall be capable of being programmed with the same programming utility as the host FACP, and saved, edited and uploaded and downloaded using the utility. UDACT shall be capable of being programmed online or offline. The programming utility shall also support upgrading UDACT operating firmware.
 - 7. The UDACT shall be capable of generating Central Station reports providing detailed programming information for each point along with the central station point address.
 - 8. An IP or IP/GSM Communicator option shall be available to interface to the UDACT and be capable of transmitting signals over the internet/intranet or Cellular (GSM) network to a compatible receiver.

D. Field Wiring Terminal Blocks

- 1. For ease of service all panel I/O wiring terminal blocks shall be removable, plug-in types and have sufficient capacity for #18 to #12 AWG wire. Terminal blocks that are permanently fixed are not acceptable.

E. Printer

- 1. The printer shall provide hard-copy printout of all changes in status of the system and shall time-stamp such printouts with the current time-of-day and date. The printer shall be standard carriage with 80-characters per line and shall use standard pin-feed paper. The printer shall be enclosed in a separate cabinet suitable for placement on a desktop or table. The printer shall communicate with the control panel using an interface complying with Electrical Industries Association standard EIA-232D. Power to the printer shall be 120 VAC @ 60 Hz.
- 2. The system shall have a strip printer capable of being mounted directly in the main FACP enclosure. Alarms shall be printed in easy-to-read RED, other messages, such as a trouble, shall be printed in BLACK. This printer shall

receive power from the system power supply and shall operate via battery back-up if AC mains are lost. The strip printer shall be UL 864 listed.

3. The system shall have a strip printer capable of being mounted directly in the main FACP enclosure. Alarms shall be printed in easy-to-read RED, other messages, such as a trouble, shall be printed in BLACK. This printer shall receive power from the system power supply and shall operate via battery back-up if AC mains are lost. The strip printer shall be UL 864 listed.

F. Smoke Control Annunciator

1. On/Auto/Off switches and status indicators (LEDS) shall be provided for monitoring and manual control of each fan, damper, HVAC control unit, stairwell pressurization fan, and smoke exhaust fan. To ensure compliance the units supplied shall meet the following UL categories: UUKL, PAZX, UDTZ, QVAX as well as the requirements of NFPA 90A, HVAC, and NFPA 92A & 92B, Smoke Control. The control System shall be field programmable for either 90A operation or 92A/B operation to allow for future use and system expansion.
2. The OFF LED shall be Yellow, the ON LED shall be green, the Trouble/Fault LED shall be Amber/Orange for each switch. The Trouble/Fault indicator shall indicate a trouble in the control and/or monitor points associated with that switch. In addition, each group of eight switches shall have two LEDS and one momentary switch which allow the following functions: An Amber LED to indicate an OFF-NORMAL switch position, in the ON or OFF position; A Green LED to indicate ALL AUTO switch position; A Local Acknowledge/Lamp Test momentary switch.
3. Each switch shall have the capability to monitor and control two addressable inputs and two addressable outputs. In all modes, the ON and OFF indicators shall continuously follow the device status not the switch position. Positive feedback shall be employed to verify correct operation of the device being controlled. Systems that indicate on/off/auto by physical switch position only are not acceptable.
4. All HVAC switches (i.e., limit switches, vane switches, etc.) shall be provided and installed by the HVAC contractor.
5. It shall be possible to meet the requirements mentioned above utilizing wall mounted custom graphic.

2.4 Gateway & Webserver Options

- A. Common Alerting Protocol (CAP) Gateway: The system shall support an optional CAP Gateway (Common Alerting Protocol). The CAP Gateway translates fire system messages to industry standard CAP messages for integration with CAP-compliant clients. A CAP gateway shall be available from the fire alarm control panel manufacturer.
- B. LEDSIGN Gateway: The system shall support an optional and proprietary LEDSIGN Gateway to interface to LED signs that will automatically display emergency

messages. The signs shall be capable of storing up to 100 messages that can be activated via system programming with the ability to be manually overridden. The Sign Gateway shall support up to 10 independent signs, each sign capable of playing an independent message. Multiple LEDSIGN Gateways can be used in network applications. An LEDSIGN gateway shall be available from the fire alarm control panel manufacturer.

- C. BACnet Interface Gateway: The system shall be capable of being interfaced with BACnet compliant clients. A BACnet interface supporting BACnet/IP communication shall be available from the fire alarm control panel manufacturer.
- D. MODbus Interface Gateway: The system shall be capable of being interfaced with MODbus compliant clients. A MODbus interface supporting MODbus/TCP communication shall be available from the fire alarm control panel manufacturer.
- E. The system shall support an IP based gateway to enable the panel or local network to be connected to a workstation via the Internet or Intranet. This gateway shall also support the ability to integrate the system to an interactive firefighter's display.
- F. Webserver: The system shall support a webserver allowing remote connection via the Internet or Intranet. Authorized users will have the ability to view panel/network history, event status and device properties. The webserver shall also support sending event information via email or text to up to 50 registered users, the webserver shall be available from the fire alarm control panel manufacturer.
- G. Web Portal Interface: The system shall be capable of being interfaced with a web portal to integrate with Inspection and Service Manager utilities. The web portal and inspection and service manager utilities shall be available from the fire alarm control panel manufacturer.

2.5 SYSTEM COMPONENTS - ADDRESSABLE DEVICES

A. Addressable Devices – General

- 1. Addressable devices shall provide an address-setting means using rotary decimal switches. Addressable devices that require the address be programmed using a programming utility are not an allowable substitute.
- 2. Addressable devices shall use simple to install and maintain decade, decimal address switches. Devices shall be capable of being set to an address in a range of 001 to 159.
- 3. Addressable devices, which use a binary-coded address setting method, such as a DIP-switch, are not an allowable substitute. Addressable devices that require the address be programmed using a special tool or programming utility are not an allowable substitute.
- 4. Addressable devices, which use a binary-coded address setting method, such as a DIP-switch, are not an allowable substitute. Addressable devices that require the address be programmed using a special tool or programming utility are not an allowable substitute.

5. Detectors shall be intelligent (analog) and addressable, and shall connect with two wires to the fire alarm control panel Signaling Line Circuits.
6. Addressable smoke and thermal detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash green under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady red illumination by the control panel, indicating that an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.
7. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. The panel on a time-of-day basis shall automatically adjust sensitivity.
8. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72.
9. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. Base options shall include a sounder base with a built-in (local) sounder rated at 85 DBA minimum, a relay base and an isolator base designed for Style 7 applications. The system shall also support an intelligent programmable sounder base, the programmable sounder base shall be capable of providing multiple tones based on programming and at a minimum be capable of providing a Temp-4 tone for CO (Carbon Monoxide) activation and a Temp-3 tone for fire activations and be capable of being synchronized with other programmable sounder bases and common area notification appliances; 85 DBA minimum.
10. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
11. Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.
12. Addressable devices shall store an internal identifying code that the control panel shall use to identify the type of device.
13. A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analog value reaching 100% of the alarm threshold.

14. Addressable modules shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box. An optional surface mount Lexan enclosure shall be available.

B. Addressable Manual Fire Alarm Box (manual station)

1. Addressable manual fire alarm boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
3. Manual fire alarm boxes shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches (44 mm) or larger.

C. Intelligent Photoelectric Smoke Detector: The intelligent photoelectric smoke detector shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

D. Intelligent VIEW® Laser Photo Smoke Detector: The intelligent laser photo smoke detector shall be a spot type detector that incorporates an extremely bright laser diode and an integral lens that focuses the light beam to a very small volume near a receiving photo sensor. The scattering of smoke particles shall activate the photo sensor.

1. The laser detector shall have conductive plastic so that dust accumulation is reduced significantly.
2. The intelligent laser photo detector shall have nine sensitivity levels and be sensitive to a minimum obscuration of 0.02 percent per foot.
3. The laser detector shall not require expensive conduit, special fittings or PVC pipe.
4. The intelligent laser photo detector shall support standard, relay, isolator and sounder detector bases.
5. The laser photo detector shall not require other cleaning requirements than those listed in NFPA 72. Replacement, refurbishment or specialized cleaning of the detector head shall not be required.
6. The laser photo detector shall include two bicolor LEDs that flash green in normal operation and turn on steady red in alarm.

E. Intelligent Ionization Smoke Detector: The intelligent ionization smoke detector shall use the dual-chamber ionization principal to measure products of combustion and

shall, on command from the control panel, send data to the panel representing the analog level of products of combustion.

- F. Intelligent Multi Criteria Acclimating Detector: The intelligent multi-criteria Acclimate® Plus™ detector shall be an addressable device that is designed to monitor a minimum of photoelectric and thermal technologies in a single sensing device. The design shall include the ability to adapt to its environment by utilizing a built-in microprocessor to determine its environment and choose the appropriate sensing settings. The detector design shall allow a wide sensitivity window, no less than 1 to 4% per foot obscuration. This detector shall utilize advanced electronics that react to slow smoldering fires and thermal properties all within a single sensing device.
 - 1. The microprocessor design shall be capable of selecting the appropriate sensitivity levels based on the environment type it is in (office, manufacturing, kitchen etc.) and then have the ability to automatically change the setting as the environment changes (as walls are moved or as the occupancy changes).
 - 2. The intelligent multi criteria detection device shall include the ability to combine the signal of the thermal sensor with the signal of the photoelectric signal in an effort to react hastily in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a false alarm condition by examining the characteristics of the thermal and smoke sensing chambers and comparing them to a database of actual fire and deceptive phenomena.
- G. Intelligent Thermal Detectors: The intelligent thermal detectors shall be addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. A high heat thermal detector rated at 190 degrees Fahrenheit shall also be available. The thermal detectors shall connect via two wires to the fire alarm control panel signaling line circuit.
- H. Intelligent Duct Smoke Detector: The smoke detector housing shall accommodate an intelligent photoelectric detector that provides continuous analog monitoring and alarm verification from the panel. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system. The Intelligent Duct Smoke Detector shall support the installation of addressable Photoelectric detector capable of being tested remotely.
- I. Multi-Criteria Intelligent Detector
 - 1. Intelligent multi-criteria fire detector shall be a Siemens model. Smoke detector shall be an addressable intelligent multi-criteria smoke detector. The detector shall be comprised of four sensing elements, including a photoelectric (light-scattering) particulate sensor, an electrochemical carbon monoxide (CO) sensor, a daylight-filtered infrared sensor and solid state thermal sensor(s) rated at 135°F (57.2°C). The device shall be able to indicate distinct smoke and heat alarms.
 - 2. The intelligent multi-criteria detection device shall include the ability to combine the signal of the photoelectric signal with other sensing elements in an effort to

react quickly in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a nuisance alarm condition. The product design shall be capable of selecting the appropriate sensitivity levels based on the environment type chosen by user in which it is installed (office, manufacturing, kitchen etc.) and then have the ability to automatically change the setting as the environment changes.

3. The detector shall be capable of automatically adjusting its sensitivity by means of drift compensation and smoothing algorithms. The detector shall be capable of automatically adjusting its sensitivity by means of drift compensation and smoothing algorithms. The device shall provide unique signals to indicate when 20% of the drift range is remaining, when 100% of drift range is used, and when there is a chamber fault to show unit requires maintenance.
4. The detector shall indicate CO trouble conditions including 6 months of sensor life remaining and sensor life has expired. The detector shall indicate a combined signal for any of the following: low chamber trouble, thermistor trouble, CO self test failure, IR self test failure, and freeze warning.
5. The detectors shall provide address-setting means on the detector head using rotary switches. Because of the possibility of installation error, systems that use binary jumpers or DIP switches to set the detector address are not acceptable. The detectors shall also store an internal identifying code that the control panel shall use to identify the type of detector. Systems that require a special programmer to set the detector address (including temporary connection at the panel) are labor intensive and not acceptable. Each detector occupies any one of at least 99 possible addresses on the signaling line circuit (SLC) loop. It responds to regular polls from the system and reports its type and status.
6. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a switch) or initiated remotely on command from the control panel. There are three test methods: functional magnet, smoke entry aerosol, or direct heat method.
7. The detectors shall provide two LEDs to provide 360° visibility. The LEDs are placed into steady red illumination by the control panel indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED, sounder base, and / or relay base (optional accessories). The external remote alarm can be interconnected to other sounder or relay bases for activating all devices in a space via a single alarming unit.
8. Two LEDs on the sensor are controlled by the panel to indicate sensor status. Coded signals, transmitted from the panel, can cause the LEDs to blink, latch on, or latch off. Refer to the control panel technical documentation for sensor LED status operation and expected delay to alarm.
9. The detectors shall be ceiling-mount and shall be plug-in mounted into a twist-lock base. These detectors shall be constructed of off-white UV resistant polymer and shall be detachable from the mounting base to simplify installation,

service and maintenance. Mounting base wiring connections shall be made by means of SEMS screws. The detector shall allow pre-wiring of the base and the head shall be a plug-in type. Mounting base shall be mounted on junction box which is at least 1.5 inches (3.81 cm) deep. Mounting base shall be available to mount to standard junction boxes. Suitable boxes include:

- a. 4.0" (10.16 cm) square box with and without plaster ring.
- b. 4.0" (10.16 cm) octagonal box.
- c. 3.5" (8.89 cm) octagonal box.
- d. Single-gang box.

10. Meets Agency Standards

- a. ANSI/UL 268 -Smoke Detectors for Fire Alarm Signaling Systems
- b. CAN/ULC-S529- Smoke Detectors for Fire Alarm Systems
- c. FM 3230-3250- Smoke Actuated Detectors for Automatic Fire Alarm Signaling

J. Multi-Criteria Intelligent Fire/CO Detector

1. Multi-Criteria Fire/CO detector shall be an addressable advanced multi-criteria smoke detector with a separate signal for carbon monoxide (CO) detection per UL 2075 standards.
2. The detector shall be comprised of four sensing elements, including a photoelectric (light-scattering) particulate sensor, an electrochemical CO sensor, a daylight-filtered infrared (IR) sensor and solid state thermal sensor(s) rated at 135°F (57.2°C). The device shall be able to indicate distinct smoke and heat alarms.
3. The advanced multi-criteria detection device shall include the ability to combine the signal of the photoelectric signal with other sensing elements in order to react quickly in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a nuisance alarm condition. The detector shall be capable of selecting the appropriate sensitivity levels based on the environment type (office, manufacturing, kitchen, etc.) in which it is installed, and then have the ability to automatically change the setting as the environment changes.
4. The CO detector component shall be capable of a functional gas test using a canned test agent to test the functionality of the CO sensing cell.
5. The detector shall be capable of automatically adjusting its sensitivity by means of drift compensation and smoothing algorithms. The device shall provide unique signals to indicate when 20 percent of the drift range is remaining, when 100

percent of drift range is used, and when there is a chamber fault to show the unit requires maintenance.

6. The detector shall indicate CO trouble conditions, including six months of sensor life remaining and sensor life has expired. The detector shall indicate a combined signal for any of the following: low chamber trouble, thermistor trouble, CO self test failure, IR self test failure, and freeze warning.
7. The detector shall provide address-setting means on the detector head using rotary switches. Because of the possibility of installation error, systems that use binary jumpers or DIP switches to set the detector address are not acceptable. The detector shall also store an internal identifying code that the control panel shall use to identify the type of detector. Systems that require a special programmer to set the detector address (including temporary connection at the panel) are labor intensive and not acceptable. Each detector occupies any one of at least 159 possible addresses on the signaling line circuit (SLC) loop. It responds to regular polls from the system and reports its type and status.
8. The detector shall provide a test means whereby it will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a switch) or initiated remotely on command from the control panel. There shall be four test methods: functional magnet, smoke entry aerosol, carbon monoxide aerosol or direct heat method.
9. The detector shall provide two LEDs to provide 360° visibility. The LEDs shall be placed into steady red illumination by the control panel indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED. The detector must be capable of connecting to a sounder base that provides both temporal 3 and temporal 4 patterns for fire and CO alarm.
10. Two LEDs on the sensor shall be controlled by the panel to indicate sensor status. Coded signals, transmitted from the panel, shall cause the LEDs to blink, latch on, or latch off. Refer to the control panel technical documentation for sensor LED status operation and expected delay to alarm.
11. The detector shall be plug-in mounted into a twist-lock base. The detector shall be constructed of off-white, UV-resistant polymer and shall be detachable from the mounting base to simplify installation, service and maintenance. Mounting base wiring connections shall be made by means of SEMS screws. The detector shall allow pre-wiring of the base and the head shall be a plug-in type. The mounting base shall be mounted on a junction box that is at least 1.5 inches (3.81 cm) deep. The mounting base shall be available to mount to standard junction boxes. Suitable boxes include:
 - a. 4.0" (10.16 cm) square box with and without plaster ring.
 - b. 4.0" (10.16 cm) octagonal box.
 - c. 3.5" (8.89 cm) octagonal box.

- d. Single-gang box.
 - e. Double-gang box
12. Meets Agency Standards
- a. ANSI/UL 268 -Smoke Detectors for Fire Alarm Signaling Systems
 - b. CAN/ULC-S529- Smoke Detectors for Fire Alarm Systems
 - c. FM 3230-3250- Smoke Actuated Detectors for Automatic Fire Alarm Signaling
 - d. UL 2075 – Gas and Vapor Detector and Sensors – Systems Connected

K. Intelligent Addressable Reflected Beam Detector

- 1. The intelligent single-ended reflected beam smoke detector shall connect with two wires to the fire alarm control panel signaling line circuit (SLC). The detectors shall consist of a transmitter/receiver unit and a reflector and shall send data to the panel representing the analog level of smoke density. The detector shall be capable of being tested remotely via a key switch. Model shall be equipped with an integral sensitivity test feature.

L. Addressable Dry Contact Monitor Module

- 1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLCs. The addressable monitor module shall be Class A or B.
- 2. The IDC zone shall be suitable for Style D/Class A or Style B/Class B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
- 3. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.
- 4. For multiple dry contact monitoring, a module shall be available that provides 10 Style B or 5 Style D input circuits.

M. Two Wire Detector Monitor Module

- 1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional 2-wire smoke detectors or alarm initiating devices (any N.O. dry contact device).
- 2. The IDC zone may be wired for Class A or B (Style D or Style B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the

monitor module is operational and in regular communication with the control panel.

3. For multiple 2-wire smoke detector circuit monitoring a module shall be available that provides 6 Style B/Class A or 3 Style D/Class B input circuits.

N. Addressable Control Module

1. Addressable control modules shall be provided to supervise and control the operation of one conventional circuit of compatible Notification Appliances, 24 VDC powered, polarized audio/visual notification appliances.
2. The control module NAC may be wired for Style Z or Style Y (Class A/B) with a current rating of 2 Amps for Style Z and 3 Amps for Style Y;
3. Audio/visual power shall be provided by a separate supervised circuit from the main fire alarm control panel or from a supervised UL listed remote supply.
4. For multiple circuit control a module shall be available that provides 6 Style Y (Class B) or 3 Style Z (Class A) control circuits.

O. Addressable Releasing Control Module

1. An addressable releasing module shall be available to supervise and control compatible releasing agent solenoids.
2. The module shall operate on a redundant protocol for added protection.
3. The module shall be configurable for Style Z or Style Y (Class A/B) and support one 24 volt or two 12 volt solenoids.

P. Addressable 4-20 mA module shall be available to monitor industry-standard, linear-scale, 4-20 mA protocol sensors. The module converts the sensor output to communication protocol that can be interpreted by the FACP for monitoring and display.

1. The module shall support programming of up to five programmable event thresholds.
2. The System shall be Factory Mutual approved as a Gas Detection system when employed with the monitor module and industry standard 4-20 mA gas detectors.

Q. Addressable Relay Module:

1. Addressable Relay Modules shall be available for HVAC control and other network building functions.
2. The module shall provide two form C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive.

3. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary devices energize at the same time on the same pair of wires;
4. For multiple relay control a module shall be available that provides 6 programmable Form-C relays.

R. Addressable Two-In / Two-Out Monitor/Relay Module:

1. An addressable Two-In / Two-Out module shall be available.
2. The two-in/two-out module shall provide two Class B/Style B dry-contact input circuits and two independent Form-C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive.

S. Isolator Module: Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC Class A or Class B branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building.

1. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
2. The isolator module shall not require address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
3. The isolator module shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

T. Serially Connected Annunciator Requirements

1. The annunciator shall communicate to the fire alarm control panel via an EIA 485 (multi-drop) two-wire communications loop. The system shall support two 6,000 ft. EIA-485 wire runs. Up to 32 annunciators, each configured up to 96 points, may be connected to the connection, for a system capacity of 3,072 points of annunciation.
2. An EIA-485 repeater shall be available to extend the EIA-485 wire distance in 3,000 ft. increments. The repeater shall be UL864 approved.
3. Each annunciator shall provide up to 96 alarm and 97 trouble indications using a long-life programmable color LED's. Up to 96 control switches shall also be available for the control of Fire Alarm Control Panel functions. The annunciator will also have an "ON-LINE" LED, local piezo sounder, local acknowledge and lamp test switch, and custom zone/function identification labels.

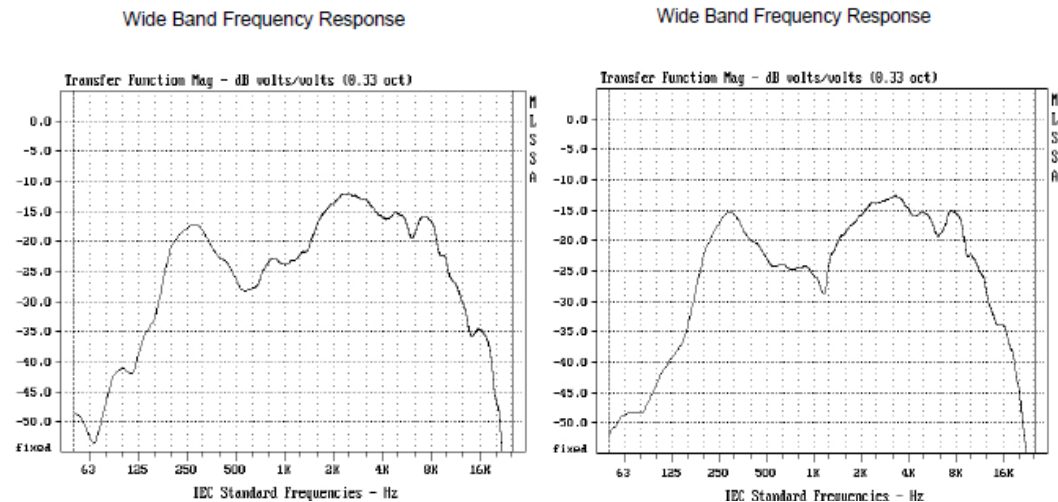
4. The annunciator may be field configured to operate as a "Fan Control Annunciator". When configured as "Fan Control," the annunciator may be used to manually control fan or damper operation and can be set to override automatic commands to all fans/dampers programmed to the annunciator.
5. Annunciator switches may be programmed for System control such as, Global Acknowledge, Global Signal Silence, Global System Reset, and on/off control of any control point in the system.
6. An optional module shall be available to utilize annunciator points to drive EIA-485 driven relays. This shall extend the system point capacity by 3,072 remote contacts.
7. The LED annunciator shall offer an interface to a graphic style annunciator and provide each of the features listed above.

U. Speakers

1. The speaker shall be listed to UL 1480 for Fire Protective Signaling Systems. It shall be a dual-voltage transformer speaker capable of operation at 25.0 or 70.7 nominal Vrms. The speaker shall have a frequency range of 400 to 4,000 Hz and shall have an operating temperature between 32°F and 120°F. It shall mount to a 4 x 4 x 2 1/8-inch back box.
2. A universal mounting plate shall be used for mounting ceiling and wall speaker products. The notification appliance circuit and amplifier wiring shall terminate at the universal mounting plate.
3. Speakers shall be plug-in and shall have the ability to check wiring continuity via a shorting spring on the universal mounting plate. The shorting spring shall also provide tamper resistance via an open circuit if the device is removed. Speaker design shall isolate speaker components to reduce ground fault incidents.
4. The speaker shall have power taps (from ¼ watt to 2 watts) and voltage that are selected by rotary switches. All models shall have a maximum sound output of 86 dB at 10 feet and shall incorporate an open back construction.
5. All notification appliances shall be backward compatible.

Ceiling Speaker

Wall Speaker



Note: The wide band frequency response is derived using MLS methods

V. Speaker Strobes

1. The speaker strobe shall be listed to UL 1971 and UL 1480 and be approved for fire protective signaling systems. It shall be a dual-voltage transformer speaker strobe capable of operation at 25.0 or 70.7 nominal Vrms. The speaker shall have a frequency range of 400 to 4,000 Hz and shall have an operating temperature between 32°F and 120°F. It shall mount to a 4 x 4 x 2 1/8-inch back box.
2. A universal mounting plate shall be used for mounting ceiling and wall speaker strobe products. The notification appliance circuit and amplifier wiring shall terminate at the universal mounting plate. Also, speaker strobes and the sync module accessory, if used, shall be powered from a non-coded notification appliance circuit output and shall operate on a nominal 12 or 24 volts (includes fire alarm panels with built in sync). When used with the sync module, 12-volt rated notification appliance circuit outputs shall operate between 8.5 and 17.5 volts; 24-volt rated notification appliance circuit outputs shall operate between 16.5 to 33 volts. If the notification appliances are not UL 9th edition listed with the corresponding panel or power supply being used, then refer to the compatibility listing of the panel to determine maximum devices on a circuit.
3. Speaker strobes shall be plug-in and shall have the ability to check wiring continuity via a shorting spring on the universal mounting plate. The shorting spring shall also provide tamper resistance via an open circuit if the device is removed. Speaker strobe design shall isolate speaker components to reduce ground fault incidents.
4. The speaker strobe shall have power taps (from ¼ watt to 2 watts) and voltage that are selected by rotary switches. All models shall have a maximum sound output of 86 dB at 10 feet and shall incorporate an open back construction. The strobe shall consist of a xenon flash tube with associated lens/reflector system and operate on either 12V or 24V. The strobe shall also feature selectable candela output, providing options for 15 or 15/75 candela when operating on 12V

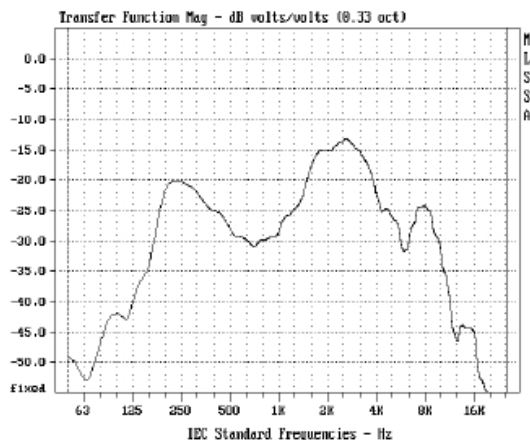
and 15, 15/75, 30, 75, 110, or 115 when operating on 24V. The strobe shall comply with NFPA 72 and the Americans with Disabilities Act requirement for visible signaling appliances, flashing at 1 Hz over the strobe's entire operating voltage range.

5. All notification appliances shall be backward compatible.

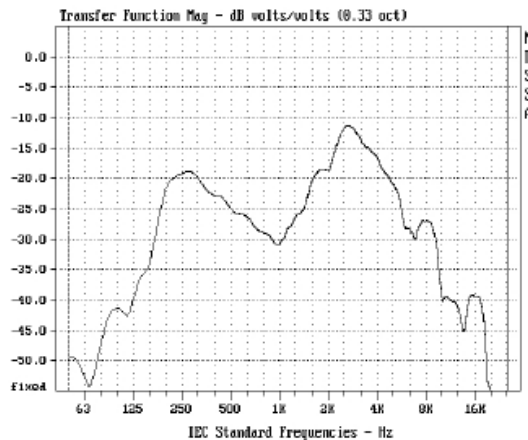
Ceiling Speaker Strobe

Wall Speaker Strobe

Wide Band Frequency Response



Wide Band Frequency Response



Note: The wide band frequency response is derived using MLS methods

6. Strobe lights shall meet the requirements of the ADA, UL Standard 1971 and be fully synchronized.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS:

- A. The wiring of the system shall be executed in accordance with the drawings and the equipment manufacturer's wiring diagrams. Should any variations in these requirements occur, the contractor shall notify the architect before making any changes. It shall be the responsibility of the factory-authorized distributor of the approved equipment to install the equipment and guarantee the system to operate as per plans and specifications.
- B. Furnish all conduit, junction boxes, conductors, equipment plugs, terminal strips, etc., and labor to install a complete and operable system.
- C. The cables within the rack or cabinets shall be carefully cabled and neatly dressed with hook-and-loop type fasteners or tie-wraps. All cables shall be numbered for identification.
- D. Splicing of conductors in underground pull boxes is not permitted.

- E. The labor employed by the contractor shall be regularly employed in the installation and repair of communication systems and shall be acceptable to the owner and architect to engage in the installation and service of this system.
- F. The contractor shall thoroughly clean all equipment and materials. All exposed parts of the equipment, cabinets, and other equipment shall be left in a clean condition, unblemished and free of all dirt, dust, smudges, spots, fingerprints, etc., the contractor shall remove all debris and rubbish occasioned by the electronic systems work from the site. The contractor shall thoroughly clean all buildings of any dirt, debris, rubbish, marks, etc., caused by the performance of this work.
- G. The system must meet all local and other prevailing codes.
- H. All cabling installations shall be performed by qualified technicians.
- I. All cabling shall be splice free.
- J. In order to ensure the least amount of cable untwisting, it is required that all cables shall be stripped using a special tool.
- K. Prior to the use of lubricants (i.e. Polywater) to facilitate the installation of cables, the contractor shall verify the acceptability of the lubricant to be used with the cable manufacturer, prior to using such a lubricant.
- L. All firewalls penetrated by structured cabling shall be sealed by use a non-permanent fire blanket or other method in compliance with the current edition of National Fire Protection Association (NFPA) and the National Electrical Code (NEC), California Electrical Code (CEC), or other prevailing code. The contractor must not use concrete or other non-removable substance for fire stopping on cable trays, wireways or conduits. Contractors who use this method will be required to replace all cables affected and provide the original specified access to each effected area.
- M. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.
- N. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.
- O. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.
- P. Manual fire alarm boxes shall be suitable for surface mounting or semi-flush mounting as shown on the plans, and shall be installed not less than 42 inches (1067 mm), nor more than 48 inches (122 mm) above the finished floor.

3.2 SPECIFIC SYSTEM INSTALLATION REQUIREMENTS

- A. The entire system shall be installed in a workmanlike manner in accordance with approved manufacturers manuals and wiring diagrams. The contractor shall furnish all wiring, conduit, outlet boxes, junction boxes, terminal cabinets and similar devices necessary for the completed installation..
- B. Installation off conduit, outlet boxes, junction boxes, terminal cabinets, special back boxes and similar devices shall comply with the requirements of Section 26 00 00 General Electrical Materials.
- C. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detector heads shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.
- D. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas. Verify with the Project Architect prior to any surface mounted installations.
- E. All penetrations of floor slabs and fire walls, shall be fire stopped in accordance with the electrical specifications.
- F. Duct mounted Smoke Detectors (when permitted for installation in writing by the engineer and District) shall be furnished and wired by this Contractor and installed by the Mechanical Contractor. All shutdown and interface wiring shall be performed by the Electrical Contractor. All air pressure differential testing shall be performed by the Mechanical/Air Balance Contractor.
- G. The sprinkler flow and tamper switches shall be furnished, installed and adjusted by the Sprinkler Contractor, wired and tested by this Contractor.

3.3 GENERAL TESTING REQUIREMENTS

- A. Provide all instruments for testing and demonstrating in the presence of the owner's inspector that the frequency response is as stated in the factory data sheets. Check all circuits and wiring to verify they are free of shorts and grounds.

3.4 SPECIFIC SYSTEM TESTING REQUIREMENTS

The service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment shall be provided to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72.

- A. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

- B. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.
- C. Verify activation of all waterflow switches.
- D. Open initiating device circuits and verify that the trouble signal actuates.
- E. Open and short signaling line circuits and verify that the trouble signal actuates.
- F. Open and short notification appliance circuits and verify that trouble signal actuates.
- G. Ground all circuits and verify response of trouble signals.
- H. Check presence and audibility of tone at all alarm notification devices.
- I. Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.
- J. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.
- K. When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.
- L. Contractor shall provide all DSA required testing and certification at no cost to the Owner.
- M. Final Acceptance
 - 1. The Owner or Owner's representative may visit the site during the installation of the system to ensure that correct installation practices are being followed.
 - 2. The Owner or Owner's representative will conduct a final job review once the contractor has finished the job. This review will take place within one week after the contractor notifies the owner.
 - 3. Two copies of all certification data and drawings for all identifications shall be provided to the Owner before the owner's review.
 - 4. The Owner or Owner's representative will review the installation and certification data prior to the system acceptance.
 - 5. The Owner or Owner's representative may test some of the systems features to ensure that the certification data is correct. If a substantial discrepancy is found, the Owner reserves the right to have an independent consultant perform a certification of the entire system. If such a procedure is undertaken, the cost of the testing will be billed back to the contractor.

6. In the event that repairs or adjustments are necessary, the contractor shall make these repairs at his own expense. All repairs shall be completed within ten (10) days from the time they are discovered.
7. The contractor shall provide not less than eight (8) hours for site instruction of personnel in the operation and maintenance of the installed systems. This instruction time shall be divided as directed by the Owner.
8. The contractor shall hand to the owner a copy of any applicable installation specific software configurations in disk format.
9. The contractor shall commission the entire system and all components in accordance with this document, the Construction Documents and Commissioning Plan, and Section 28 08 00 Commissioning of Electronic Safety and Security Systems.

3.5 FINAL INSPECTION:

- A. At the final inspection, a factory-trained representative of the manufacturer of the major equipment shall demonstrate that the system functions properly in every respect.

3.6 INSTRUCTION:

- A. Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.
- B. The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation."

END OF SECTION

SECTION 31 10 00

SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. "Geotechnical Investigation Venetia Valley K-8 School", prepared by Miller Pacific Engineering Group, dated April 27, 2017.

1.2 SUMMARY

- A. Section Includes:
 - 1. Protecting existing vegetation to remain.
 - 2. Removing existing vegetation.
 - 3. Clearing and grubbing.
 - 4. Stripping and stockpiling topsoil.
 - 5. Stripping and stockpiling rock.
 - 6. Removing above and below grade site improvements.
 - 7. Disconnecting, capping or sealing, and removing site utilities.
 - 8. Temporary erosion and sedimentation control.
- B. Related Requirements:
 - 1. Section 31 25 00 "Erosion & Sediment Control" for temporary erosion and sedimentation control measures.

1.3 RELATED SECTIONS

- A. Section 02 40 00 – Demolition.
- B. Section 31 25 00 – Erosion & Sediment Control.

1.4 DEFINITIONS

- A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

- B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.
- C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow.
- D. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally 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 larger than 2 inches (50 mm) in diameter; and free of weeds, roots, toxic materials, or other nonsoil materials.
- E. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.
- F. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated on Drawings.
- G. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.6 MATERIAL OWNERSHIP

- A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.7 INFORMATIONAL SUBMITTALS

- A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
 - 1. Use sufficiently detailed photographs or video recordings.
 - 2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.
- B. Topsoil stripping and stockpiling program.
- C. Rock stockpiling program.
- D. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

- E. Burning: Documentation of compliance with burning requirements and permitting of authorities having jurisdiction. Identify location(s) and conditions under which burning will be performed.

1.8 QUALITY ASSURANCE

- A. Topsoil Stripping and Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.
- B. Rock Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.

1.9 FIELD CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
 - 1. Do not proceed with work on adjoining property until directed by Architect.
- C. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where directed.
- D. Utility Locator Service: Notify USA North Call Before You Dig for area where Project is located before site clearing.
- E. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.
- F. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 31 20 00 "Earth Moving."
 - 1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.
- B. Antirust Coating: Fast-curing, lead and chromate-free, self-curing, universal modified-alkyd primer complying with MPI #23 (surface-tolerant, anticorrosive metal primer).

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion and sedimentation control Drawings and requirements of authorities having jurisdiction.
- B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- C. Inspect, maintain, and repair erosion and sedimentation control measures during construction until permanent vegetation has been established.
- D. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

3.3 EXISTING UTILITIES

- A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.
- B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed.
 1. Arrange with utility companies to shut off indicated utilities.
 2. Owner will arrange to shut off indicated utilities when requested by Contractor.
- C. Locate, identify, and disconnect utilities indicated to be abandoned in place.
- D. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 1. Notify Architect not less than two days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Architect's written permission.
- E. Excavate for and remove underground utilities indicated to be removed.
- F. Removal of underground utilities is included in Section 02 40 00 "Demolition."

3.4 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 2. Grind down stumps and remove roots larger than 2 inches (50 mm) in diameter, obstructions, and debris to a depth of 18 inches (450 mm) below exposed subgrade.
 3. Use only hand methods or air spade for grubbing within protection zones.
 4. Chip removed tree branches and stockpile in areas approved by Architect.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
 1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches (200 mm), and compact each layer to a density equal to adjacent original ground.
 2. Excavate any loose soil or rock to expose firm natural soils or bedrock.
 3. Debris, rocks larger than six inches and vegetation are not suitable for structural fill and should be removed from the site.

3.5 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to depth of 6 inches (150 mm) in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches (50 mm) in diameter; trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
 1. Limit height of topsoil stockpiles to 72 inches (1800 mm).
 2. Do not stockpile topsoil within protection zones.
 3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
 4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.6 STOCKPILING ROCK

- A. Remove from construction area naturally formed rocks that measure more than 1 foot (300 mm) across in least dimension. Do not include excavated or crushed rock.
 1. Separate or wash off non-rock materials from rocks, including soil, clay lumps, gravel, and other objects larger than 2 inches (50 mm) in diameter; trash, debris, weeds, roots, and other waste materials.
- B. Stockpile rock away from edge of excavations without intermixing with other materials. Cover to prevent windblown debris from accumulating among rocks.
 1. Limit height of rock stockpiles to 36 inches (900 mm).
 2. Do not stockpile rock within protection zones.
 3. Dispose of surplus rock. Surplus rock is that which exceeds quantity indicated to be stockpiled or reused.
 4. Stockpile surplus rock to allow later use by the Owner.

3.7 SITE IMPROVEMENTS

- A. Remove existing above and below-grade improvements as indicated and necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
 2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
- B. Burning tree, shrub, and other vegetation waste is permitted according to burning requirements and permitting of authorities having jurisdiction. Control such burning to produce the least smoke or air pollutants and minimum annoyance to surrounding properties. Burning of other waste and debris is prohibited.
- C. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials, and transport them to recycling facilities. Do not interfere with other Project work.

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SECTION 31 20 00

EARTH MOVING

GENERAL

1.1 SECTION INCLUDES

- PART 1 -** A. Excavation and/or embankment from existing ground to subgrade, including soil sterilant, for roadways, driveways, parking areas, building pads, walks, paths, or trails and any other site improvements called for on the Plans.

1.2 SECTION EXCLUDES

- A. Earthwork related to underground utility installation shall be performed in accordance with Sections 31 23 33 Trenching and Backfill.

1.3 RELATED SECTIONS

- A. Section 015050, Erosion Control
B. Section 311000, Site Clearing

1.4 RELATED DOCUMENTS

- A. "Geotechnical Investigation Venetia Valley K-8 School", prepared by Miller Pacific Engineering Group, dated April 27, 2017.
- B. ASTM
1. D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort
 2. D1586, Method for Penetration Tests and Split-Barrel Sampling of Soils
 3. D2487, Classification of Soils for Engineering Purposes
 4. D3740, Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
 5. D4318. Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils
 6. E329, Specification for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
 7. E548, Guide for General Criteria Used for Evaluating Laboratory Competence
- C. California Building Code, California Code of Regulations, Title 24, Part 2, Chapter 18, Soils and Foundations, and Chapter 33, Safeguards During Construction

- D. Caltrans Standard Specifications, 2022
 - 1. Section 17, General
 - 2. Section 19, Earthwork
- E. CAL/OSHA, Title 8.

1.5 DEFINITIONS

- A. Borrow: Approved soil material imported from off-site for use as Structural Fill or Backfill.
- B. Excavation: Removal of material encountered above subgrade elevations.
 - 1. Authorized Over-Excavation: Excavation below subgrade elevations or beyond indicated horizontal dimensions as shown on plans or authorized by the Geotechnical Engineer.
 - 2. Unauthorized Over-Excavation: Excavation below subgrade elevations or beyond indicated horizontal dimensions without authorization by the Geotechnical Engineer. Unauthorized excavation shall be without additional compensation.
- C. Geotechnical Testing Agency: An independent testing agency qualified according to ASTM E329 to conduct soil materials and rock definition testing, as documented according to ASTM D3740 and ASTM E548.
- D. Structural Backfill: Soil materials approved by the Geotechnical Engineer and used to fill excavations resulting from removal of existing below grade facilities, including trees.
- E. Structural Fill: Soil materials approved by the Geotechnical Engineer and used to raise existing grades.
- F. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material $\frac{3}{4}$ cubic yards or more in volume that when tested by an independent geotechnical testing agency, according to ASTM D1586, exceeds a standard penetration resistance of 100 blows/2 inches.
- G. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below grade.
- H. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, base or topsoil materials.
- I. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of weeds, roots, and other deleterious materials.

- J. Unsuitable Material: Any soil material that is not suitable for a specific use on the Project. The Geotechnical Engineer will determine if a soil material is unsuitable.
- K. Relative Compaction: In-place dry density of soil expressed as percentage of maximum dry density of same materials, as determined by laboratory test procedure ASTM D1557.
- L. Utilities: onsite underground pipes, conduits, ducts and cables.

1.6 SUBMITTALS

- A. Samples:
 - 1. If required by the Geotechnical Engineer, provide 20 pound samples, sealed in airtight containers, tagged with source locations and suppliers of each proposed soil material from on-site or borrow sources, 72 hours prior to use. Do not import materials to the Project without written approval of the Geotechnical Engineer.
 - 2. Provide materials from same source throughout work. Change of source requires approval of the Geotechnical Engineer.
- B. Material Test Reports: Provide, from a qualified testing agency, the following test results showing compliance with the project requirements
- C. Classification according to ASTM D2487 of each onsite or borrow soil material proposed for fill and backfill.
 - 1. Laboratory compaction curve in conformance with ASTM D1557 for each onsite or borrow soil material proposed for fill and backfill.

1.7 QUALITY ASSURANCE

- A. Provide an independent testing agency qualified according to ASTM E329 to conduct soil materials and rock definition testing, as documented according to ASTM D3740 and ASTM E548.
- B. Conform all work and materials to the recommendations or requirements of the Geotechnical Report and meet the approval of the Geotechnical Engineer.
- C. Conform all work in accordance with Caltrans Standard Specification Section 17, General and Section 19, Earthwork.
- D. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM D1557.
- E. Perform excavation, filling, compaction and related earthwork under the observation of the Geotechnical Engineer. Materials placed without approval of the Geotechnical Engineer will be presumed to be defective and, at the discretion of

the Geotechnical Engineer, shall be removed and replaced at no cost to the City of San Rafael. Notify the Geotechnical Engineer at least 24 hours prior to commencement of earthwork and at least 48 hours prior to testing or as agreed upon with owner.

- F. The Geotechnical Engineer will perform observations and tests required to enable him to form an opinion of the acceptability of the Project earthwork. Correct earthwork that, in the opinion of the Geotechnical Engineer, does not meet the requirements of these Technical Specifications and the Geotechnical Report.
- G. Upon completion of the construction work, certify that all compacted fills and foundations are in place at the correct locations, and have been constructed in accordance with sound construction practice. In addition, certify that the materials used are of the types, quality and quantity required by these Technical Specifications and the Geotechnical Report. The Contractor shall be responsible for the stability of all fills and backfills constructed by his forces and shall replace portions that in the opinion of the Geotechnical Engineer have been displaced or are otherwise unsatisfactory due to the Contractor's operations.
- H. Finish subgrade tolerance at completion of grading:
 - 1. Building and paved areas: ± 0.05 feet
 - 2. Other areas: ± 0.10 feet

1.8 PROJECT CONDITIONS

- A. Promptly notify the Resident Engineer of surface or subsurface conditions differing from those disclosed in the Geotechnical Report. First notify the Resident Engineer verbally to permit verification and extent of condition and then in writing. No claim for conditions differing from those anticipated in the Contract Documents and disclosed in the Geotechnical Report will be allowed unless the Contractor has notified the Resident Engineer in writing of differing conditions prior to the Contractor starting work on affected items.
- B. Protect open excavations, trenches, and the like with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.
- C. Prevent erosion of freshly-graded areas during construction and until such time as permanent drainage and erosion control measures have been installed in accordance with Section 01 50 50, Erosion Control.
- D. Temporarily stock-pile fill material in an orderly and safe manner and in a location approved by the Resident Engineer.
- E. Environmental Requirements: When unfavorable weather conditions necessitate interrupting earthwork operation, areas shall be prepared by compaction of surface and grading to avoid collection of water. Provide adequate temporary drainage to prevent erosion. After interruption, compaction specified in last layer shall be re-established before resuming work.

PRODUCTS

SOIL MATERIALS

- PART 2 -**
- 2.01**
- A. General: On-site soils are considered suitable for use as fill provided the materials are placed in accordance with Geotechnical Recommendations. Highly expansive soils shall not be used as select structural fill, or used as backfill for trenches located within hardscape areas.
- B. Imported fill soils, if required, should be predominantly granular in nature, and should be free of organics, debris, or rocks over 3 inches in size, and shall be approved by the Geotechnical Engineer before importing to the site. Imported non-expansive soils shall have a Plasticity Index less than 15 as determined by ASTM D4318, an R-value of at least 20, and fines content between 15 and 65 percent. Import fill shall be considered non-hazardous per Department of Toxic Substances Control guidelines (DTSC, 2017) and non-corrosive per Caltrans Corrosion Guidelines (Caltrans, 2015).

SOIL STERILANT

- 2.02**
- A. Commercial chemical for weed control, registered by EPA. Provide granular, liquid or wet-able powder form.

PART 3 - EXECUTION

3.01 GENERAL

- A. Placement and compaction of material by flooding, ponding, or jetting will not be permitted.
- B. The use of explosives will not be permitted.
- C. Grading and earthwork operations shall be observed and tested by a representative of the Geotechnical Engineer for conformance with the project plans/specifications and the geotechnical recommendations. This work includes site preparation, selection of satisfactory materials, and placement and compaction of the subgrades and fills. Sufficient notification prior to commencement of earthwork is essential to make certain that the work will be properly observed.
- 3.02**

CONTROL OF WATER AND DEWATERING

- A. Comply with Section 312319, Dewatering, if dewatering is necessary.
- B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding the site and surrounding area. Provide dewatering equipment necessary to drain and keep excavations and site free from water.

- C. Dewater during backfilling operation so that groundwater is maintained a least 1 foot below level of compaction effort.
- D. Obtain the Geotechnical Engineer's approval for proposed control of water and dewatering methods.
- E. Protect subgrades from softening, undermining, washout and damage by rain or water accumulation.
- F. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations.
- G. Maintain dewatering system in place until dewatering is no longer required.

WET WEATHER CONDITIONS

3.03

- A. Do not prepare subgrade, place or compact soil materials if subgrade or materials are above optimum moisture content.
- B. If the Geotechnical Engineer allows work to continue during wet weather conditions, conform to supplemental recommendations provided by the Geotechnical Engineer.

BRACING AND SHORING

3.04

- A. Conform to California and Federal OSHA requirements.
- B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the facility being constructed; and to prevent damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.
- C. Be solely responsible for all bracing and shoring and, if requested by the Resident Engineer, submit details and calculations to the Resident Engineer. The Resident Engineer may forward the submittal to the Geotechnical Engineer, the Consulting Engineer and/or the California Division of Industrial Safety for their review. The Contractor's submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in California. No excavations related to the proposed facility shall precede a response to the submittal by the Resident Engineer.

3.05

- D. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the position or operation of the facility being constructed or adjacent utilities and facilities.

TOPSOIL STRIPPING

- A. Remove topsoil in accordance with Section 311000, Site Clearing.

EXCAVATION

- A. Excavate earth and rock to lines and grades shown on plans and to the neat dimensions indicated on the plans, required herein or as required to satisfactorily compact backfill.
- 3.06 B. Remove and dispose of large rocks, pieces of concrete and other obstructions encountered during excavation.
- C. Excavation through buried concrete and other unknown obstructions will require specialized techniques for demolition and removal.
- D. Where forming is required, excavate only as much material as necessary to permit placing and removing forms.
- E. Provide supports, shoring and sheet piles required to support the sides of excavations or for protection of adjacent existing improvements.

GRADING

- 3.07 A. Uniformly grade the Project to the elevations shown on plans
- B. Finish ditches, gutters and swales to the sections, lines and grades indicated and to permit proper surface drainage.
- C. Round tops and bottoms of slopes as indicated or to blend with existing contours.

3.08

SUBGRADE PREPARATION

- A. Subgrade Preparation: Prior to backfilling depressions created by the removal of old foundations and utility lines, scarify the bottom of the excavation to an approximate depth of 8 inches and uniformly moisture condition the scarified surfaces to a moisture content that is at least 2 percent over optimum. Compact the scarified surfaces to a minimum of 90 percent relative compaction at above optimum moisture content.
- B. Over-excavate any remaining soft (pumping) areas down to firm soil and backfill the area.
- C. Subgrade shall be maintained in a moist, but not wet, condition by periodically sprinkling water prior to the placement of additional fill or installation of roads. Subgrade that has been permitted to dry out and loosen or develop desiccation cracking should be scarified, moisture conditioned, and re-compacted as recommended above.
- D. Install underground utilities and service connections prior to final preparation of subgrade and placement of base materials for final surface facilities. Extend services so that final surface facilities are not disturbed when service connections are made.

- E. Prepare subgrades under the structural section of paved areas, curbs, gutters, walks, structures, other surface facilities and areas to receive structural fill.
- F. Protect utilities from damage during compaction of subgrades and until placement of final pavements or other surface facilities.
- G. Obtain the Geotechnical Engineer's approval of subgrades prior to placing pavement structural section.

KEYWAYS AND BENCHES

3.09

- A. Provide keyways as indicated for fill slopes steeper than 6 horizontal to 1 vertical. Extend keyway 5 feet minimum into competent, undisturbed soil or 3 feet minimum into competent, undisturbed rock as directed by the Geotechnical Engineer.
- B. Place subsurface drains in bottom of keyway in accordance with Section 334600, Subdrainage.
- C. Bench subgrade as indicated above toe of fill.
- D. Place subsurface drains at benches every 20 vertical feet or as directed by the Geotechnical Engineer.

3.10

LOT FINISH GRADING

- A. Blade finish lots to lines and grades indicated.

3.11

FILL PLACEMENT AND COMPACTION

- A. Place fill in uniformly moisture conditioned and compacted lifts not exceeding 8 inches in loose thickness. Each lift should be thoroughly moisture conditioned and compacted to 90 percent before successive fill layers are placed.
- B. In order to achieve satisfactory compaction in the subgrade and fill soils, it may be necessary to adjust the soil moisture content at the time of soil compaction per geotechnical recommendations. This may require that water be added and thoroughly mixed into any soils which are too dry or that scarification and aeration be performed in any soils which are too wet.
- C. Obtain the Geotechnical Engineer's approval of surface to receive structural fill prior to placement of structural fill material.
- D. Place structural fill on prepared subgrade.
- E. Do not drop fill on structures. Do not backfill around, against or upon concrete or masonry structures until structure has attained sufficient strength to withstand loads imposed and the horizontal structural system had been installed.
- F. Do not compact by ponding, flooding or jetting.
- G. Perform compaction using rollers, pneumatic or vibratory compactors or other equipment and mechanical methods approved by the Geotechnical Engineer.

H. Compaction requirements

1. Compact structural fills less than 5 feet thick to 90 percent compaction.
2. Compact structural fill 5 feet thick or greater to 95 percent compaction.
3. Compact the upper 6 inches of subgrade soils beneath pavements, curbs and gutters to 95 percent compaction. Extend compaction 5 feet beyond pavement edges unless specified otherwise by the Geotechnical Engineer.
4. Compact the upper 6 inches of subgrade soils under walks, structures and areas to receive structural fill to 90 percent compaction.

SOIL STERILIZATION

- 3.12
- A. Apply soil sterilant to areas indicated, such as beneath asphalt concrete pavement, brick pavement, concrete pavement and at grade concrete slabs, including sidewalks, curbs and gutters. Also, where indicated apply soil sterilant below expansion and control joints and at areas where pipes, ducts or other features penetrate slabs.
- B. Apply soil sterilant uniformly and at the rates recommended by the manufacturer.
- C. Apply soil sterilant to prepared subgrade, or after installation of aggregate base as recommended by the manufacturer.

DISPOSAL

- 3.13
- A. Lawfully dispose of all unsuitable and excess or surplus material off-site at no cost to the City of San Rafael.

END OF SECTION

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SECTION 31 23 33

TRENCHING AND BACKFILLING

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Excavation, bedding, and backfill for underground storm drain, sanitary sewer, and water piping and associated structures.

1.2 SECTION EXCLUDES

- A. Trenching and backfill for other utilities such as underground HVAC piping, electrical conduit, telephone conduit, gas piping, cable TV conduit, etc.

1.3 RELATED SECTIONS

- A. Section 31 20 00 – Earth Moving
- B. Section 33 05 16 – Utility Structures
- C. Section 33 40 00 – Storm Drainage Utilities

1.4 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. “Geotechnical Investigation Venetia Valley K-8 School”, prepared by Miller Pacific Engineering Group, dated April 27, 2017.
- C. ASTM:
 - 1. C 33, Specification for Concrete Aggregates.
 - 2. C 150, Specification for Portland Cement.
 - 3. C 260, Specification for Air-Entraining Admixtures for Concrete.
 - 4. C 618, Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
 - 5. D 1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
 - 6. D 2321, Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
 - 7. D 2487, Classification of Soils for Engineering Purposes.
 - 8. D 3740, Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
 - 9. E 329, Specification for Minimum Requirements for Agencies Engaged in the

- Testing and/or Inspection of Materials Used in Construction.
- 10. E 548, Guide for General Criteria Used for Evaluating Laboratory Competence.
- D. California Administrative Code, Title 24, Part 2 - Basic Building Regulations, Chapter 24, Excavations, Foundations, and Retaining Walls.
- E. Caltrans Standard Specifications:
 - 1. Section 19, Earthwork.
 - 2. Section 26, Aggregate Bases.
 - 3. Section 68, Subsurface Drains.
 - 4. Section 88, Engineering Fabrics.
- F. CAL/OSHA, Title 8.

1.5 DEFINITIONS

- A. AC: Asphalt Concrete.
- B. ASTM: American Society for Testing and Materials.
- C. Bedding: Material from bottom of trench to bottom of pipe.
- D. CDF: Controlled Density Fill.
- E. DIP: Ductile Iron Pipe.
- F. Initial Backfill: Material from bottom of pipe to 12-inches above top of pipe.
- G. PCC: Portland Cement Concrete.
- H. RCP: Reinforced Concrete Pipe.
- I. Springline of Pipe: Imaginary line on surface of pipe at a vertical distance of $\frac{1}{2}$ the outside diameter measured from the top or bottom of the pipe.
- J. Subsequent Backfill: Material from 12-inches above top of pipe to subgrade of surface material or subgrade of surface facility or to finish grade.
- K. Trench Excavation: Removal of material encountered above subgrade elevations and within horizontal trench dimensions.
 - 1. Authorized Trench Over-Excavation: Excavation below trench subgrade elevations or beyond indicated horizontal trench dimensions as shown on plans or authorized by the Geotechnical Consultant.
 - 2. Unauthorized Trench Over-Excavation: Excavation below trench subgrade elevations or beyond indicated horizontal trench dimensions without authorization by the Geotechnical Consultant. Unauthorized excavation shall be without additional compensation.
- L. Utility Structures:
 - 1. Storm drainage manholes, catch basins, drop inlets, curb inlets, vaults, etc.
 - 2. Sanitary sewer manholes, vaults, etc.
 - 3. Water vaults, etc.

1.6 SUBMITTALS

- A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.
- B. Product Data:
 - 1. Grading and quality characteristics showing compliance with requirements for the Work.
 - 2. Certify that material meets requirements of the Project.
- C. Samples:
 - 1. If required by the Geotechnical Consultant, provide 40-pound samples of all imported trench bedding and backfill material sealed in airtight containers, tagged with source locations and suppliers of each proposed material. Do not import materials to Project without written approval of the Geotechnical Consultant.
 - 2. Provide materials from same source throughout work. Change of source requires approval of the Geotechnical Consultant and the Owner.

1.7 QUALITY ASSURANCE

- A. Conform all work and materials to the recommendations or requirements of the Geotechnical Report and meet the approval of the Geotechnical Consultant.
- B. Conform all work to the appropriate portion(s) of the Caltrans Standard Specifications, Section 19.
- C. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM D 1557.
- D. The Geotechnical Consultant will perform observations and tests required to enable him to form an opinion of the acceptability of the trench backfill. Correct the trench backfill that, in the opinion of the Geotechnical Consultant, does not meet the requirements of these Technical Specifications and the Geotechnical Report.

1.8 PROJECT CONDITIONS

- A. Promptly notify the Owner of surface or subsurface conditions differing from those disclosed in the Geotechnical Report. First notify the Owner verbally to permit verification and extent of condition and then in writing. No claim for conditions differing from those anticipated in the Contract Documents and disclosed in the Geotechnical Report will be allowed unless Contractor has notified the Owner in writing of differing conditions prior to contractor starting work on affected items.
- B. Protect open, trenches, and utility structure excavations with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.
- C. Stockpile on-site and imported backfill material temporarily in an orderly and safe manner.

PART 2 - PRODUCTS

2.1 PIPE BEDDING AND INITIAL BACKFILL

- A. ASTM D 2321, Class IA, IB or II.
 - 1. Clean and free of clay, silt or organic matter.
- B. Permeable Material: Conform to Section 68-1.025 of Caltrans Standard Specifications, Class 1, Type A or Class 2.
- C. Class 2 Aggregate Base: Conform to Section 26 of Caltrans Standard Specifications, $\frac{3}{4}$ -inch maximum.
- D. Sand: Conform to Section 19-3.025B of Caltrans Standard Specifications.

2.2 WARNING TAPE

- A. See Section 33 10 00 – Water Utilities.

2.3 SUBSEQUENT BACKFILL

- A. Conform to on-site or imported structural backfill in Section 31 20 00 – Earth Moving.

2.4 CONTROLLED DENSITY FILL (CDF) (in trenches)

- A. Provide non-structural CDF, from bottom of trench to finish subgrade of subbase or base material, that can be excavated by hand and produce unconfined compressive 28-day strengths from 50-psi to a maximum of 150-psi. Provide aggregate no larger than $\frac{3}{8}$ -inch top size. The $\frac{3}{8}$ -inch aggregate shall not comprise more than 30% of the total aggregate content.
- B. Cement: Conform to the standards as set forth in ASTM C-150, Type II Cement.
- C. Fly Ash: Conform to the standards as set forth in ASTM C-618, for Class F Pozzolan. Do not inhibit the entrainment of air with the fly ash.
- D. Air Entraining Agent: Conform to the standards as set forth in ASTM C-260.
- E. Aggregates need not meet the standards as set forth in ASTM C-33. Any aggregate, producing performances characteristics described herein will be accepted for consideration. The amount of material passing a #200 sieve shall not exceed 12% and no plastic fines shall be present.
- F. Provide CDF that is a mixture of cement, Class F Pozzolan, aggregate, air entraining agent and water. CDF shall be batched by a ready mixed concrete plant and delivered to the job site by means of transit mixing trucks.
- G. The Contractor shall determine the actual mix proportions of the controlled density fill to meet job site conditions, minimum and maximum strengths, and unit weight.

Entrained air content shall be a minimum of 4.0%. The actual entrained air content shall be established for each job with the materials and aggregates to be used to meet the placing and unit weight requirements. Entrained air content may be as high as 20% for fluidity requirements.

- H. Mix design shall meet the Geotechnical Consultant's approval.

2.5 CONCRETE STRUCTURE BEDDING AND BACKFILL

- A. Precast Structures: Same materials to the same heights as specified for pipe bedding and backfill, or other material approved by the Geotechnical Consultant.
- B. Poured-in-Place Structures:
1. Bedding: Bedding shall meet the approval of the Geotechnical Consultant. In general, bedding is not required, pour bases against undisturbed native earth in cut areas and against engineered fill compacted to 90% relative compaction in embankment areas.
 2. Side Backfill: On-site or imported structural fill meeting the requirements given in Section 31 20 00 – Earth Moving.

2.6 FILTER FABRIC

- A. Filter Fabric:
1. Filter Fabric: Section 88-1.03 of Caltrans Standard Specifications.
 2. Mirifi 140N (Mirifi Inc., Charlotte, NC) (Tel. 800-438-1855) or equal.

PART 3 - EXECUTION

3.1 TRENCHING AND EXCAVATION

- A. Existing PCC or AC Areas: Cut PCC or AC to full depth at a minimum distance of 12-inches beyond the edge of the trench.
- B. Excavate by hand or machine. For gravity systems begin excavation at the outlet end and proceed upstream. Excavate sides of the trench parallel and equal distant from the centerline of the pipe. Hand trim excavation. Remove loose matter.
- C. Excavation Depth for Bedding: Minimum of 4-inches below bottom of pipe or as otherwise allowed or required by the Geotechnical Consultant, except that bedding is not required for nominal pipe diameters of 2-inches or less.
- D. Excavation Width at Springline of Pipe:
1. Up to a nominal pipe diameter of 24-inches: Minimum of twice the outside pipe diameter, or as otherwise allowed or required by the Geotechnical Consultant.
 2. Nominal pipe diameter of 30-inches through 36-inches: Minimum of the outside pipe diameter plus 2-feet, or as otherwise allowed or required by the Geotechnical Consultant.
 3. Nominal pipe diameter of 42-inches through 60-inches: Minimum of the outside pipe diameter plus 3-feet, or as otherwise allowed or required by the

Geotechnical Consultant.

- E. Over-Excavations: Backfill trenches that have been excavated below bedding design subgrade, with approved bedding material.
- F. Comply with the Owner's limitations on the amount of trench that is opened or partially opened at any one time. Do not leave trenches open overnight without the approval of the Owner.
- G. Where forming is required, excavate only as much material as necessary to permit placing and removal of forms.
- H. Bottoms of trenches will be subject to testing by Geotechnical Consultant. Correct deficiencies as directed by the Geotechnical Consultant.
- I. Grade bottom of trench to provide uniform thickness of bedding material and to provide uniform bearing and support for pipe along entire length. Remove stones to avoid point bearing.

3.2 CONTROL OF WATER AND DEWATERING

- A. Be solely responsible for dewatering trenches and excavations and subsequent control of ground and surface water. Provide and maintain such pumps or other equipment as may be necessary to control ground water and seepage to the satisfaction of the Geotechnical Consultant and the Owner until backfilling is completed.
- B. Dewater during backfilling operation so that groundwater is maintained a least one foot below level of compaction effort.
- C. Obtain the Geotechnical Consultant's approval for proposed control of water and dewatering methods.
- D. Reroute surface water runoff away from open trenches and excavations. Do not allow water to accumulate in trenches and excavations.
- E. Maintain dewatering system in place until dewatering is no longer required.

3.3 BRACING AND SHORING

- A. Conform to California and Federal OSHA requirements.
- B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the pipes and appurtenances being constructed; and to prevent damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.
- C. Be solely responsible for all bracing and shoring and, if requested by the Owner, submit details and calculations to the Owner. The Owner may forward the submittal to the Geotechnical Consultant, the Consulting Engineer and/or the California Division of Industrial Safety for their review. The Contractor's submittal shall include the basic

design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in California. No excavations in trench section or around structures shall precede a response to the submittal by the Owner.

- D. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the line, grade, or backfill compaction or operation of the utility being installed or adjacent utilities and facilities.

3.4 PIPE BEDDING

- A. Obtain approval of bedding material from the Geotechnical Consultant.
- B. Accurately shape bedding material to the line and grade called for on the Plans. Carefully place and compact bedding material to the elevation of the bottom of the pipe in layers not exceeding 8-inches in loose thickness. Compact bedding material at optimum water content to 90% relative compaction unless specified otherwise on the Plans or by the Geotechnical Consultant. Compact by pneumatic tampers or other mechanical means approved by the Geotechnical Consultant. Jetting or ponding of bedding material will not be permitted.
- C. Upon completion of bedding operations, and prior to the installation of pipe, notify the Geotechnical Consultant, who will inspect the bedding layer. Do not commence pipe laying until the Geotechnical Consultant has approved the bedding.

3.5 WARNING TAPE

- A. Install in accordance with Section 33 10 00 – Water Utilities.

3.6 BACKFILLING

- A. Obtain approval of backfill material from Geotechnical Consultant.
- B. Bring initial backfill up simultaneously on both sides of the pipe, so as to prevent any displacement of the pipe from its true alignment. Carefully place and compact initial backfill material to an elevation of 12-inches above the top of the pipe in layers not exceeding 8-inches in loose thickness. Compact bedding material at optimum water content to 90% relative compaction unless specified otherwise on the Plans or by the Geotechnical Consultant. Compact by pneumatic tampers or other mechanical means approved by the Geotechnical Consultant. Jetting or ponding of initial backfill material will not be permitted.
- C. Bring subsequent backfill to subgrade or finish grade as indicated. Carefully place and compact subsequent backfill material to the proper elevation in layers not exceeding 8-inches in loose thickness. Compact bedding material at optimum water content to 90% relative compaction, except that the upper 36-inches in areas subject to vehicular traffic shall be compacted to at least 95% relative compaction, unless specified otherwise on the Plans or by the Geotechnical Consultant. Compact by pneumatic tampers or other mechanical means approved by the Geotechnical Consultant. Jetting

or ponding of subsequent backfill material will not be permitted.

- D. Do not use compaction equipment or methods that produce horizontal or vertical earth pressures that may cause excessive pipe displacement or damage the pipe.
- E. Utility backfill shall be inspected and tested by the Geotechnical Consultant during placement. Cooperate with the Geotechnical Consultant and provide working space for such tests in operations. Backfill not compacted in accordance with these specifications shall be re-compacted or removed as necessary and replaced to meet the specified requirements, to the satisfaction of the Geotechnical Consultant and the Owner prior to proceeding with the Project.

3.7 CLEANUP

- A. Upon completion of utility earthwork all lines, manholes catch basins, inlets, water meter boxes and other structures shall be thoroughly cleaned of dirt, rubbish, debris and obstructions of any kind to the satisfaction of the Owner.

END OF SECTION

SECTION 31 25 00

EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 RELATED SECTIONS

- A. Section 31 10 00 – Site Clearing

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. “Geotechnical Investigation Venetia Valley K-8 School”, prepared by Miller Pacific Engineering Group, dated April 27, 2017.
- C. Storm Water Pollution Prevention Plan.

1.3 SUMMARY

- A. Provide all material, labor, equipment, for installation, implementation, and maintenance of all surface-water pollution prevention measures. This work includes the following:
 - 1. Furnishing, placing, and installing effective measures for preventing erosion and runoff of soil, silts, gravel, hazardous chemicals or other materials prohibited by the San Francisco Bay Region Water Quality Control Board from entering the stormwater drainage system.
 - 2. Management of on-site construction materials in such a manner as to prevent said materials from contacting stormwater or wash water and running off into the storm drain system.
 - 3. Implementing dust control measures.
 - 4. Complying with applicable standards and regulations.
 - 5. Maintain good housekeeping at the project site.
- B. Storm drains discharge directly to creeks and the Bay without treatment. Discharge of pollutants (any substance, material, or waste other than uncontaminated storm water) from this project into the storm drain system is strictly prohibited by the California Regional Water Quality Control Board’s (RWQCB) Water Quality Control Plan (Basin Plan).

1.4 WORK SPECIFIED ELSEWHERE

- A. Consult all other Specification sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete operational installation.

1.5 REGULATIONS AND STANDARDS

- A. Contractor shall comply with the following applicable regulations:
 - 1. Clean Water Act, United States Environmental Protection Agency, and Porter-Cologne Clean Water Act, State of California.
 - 2. NPDES General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities, Order No. 2009-0009-DWQ, and as amended.

1.6 DEFINITION OF TERMS

- A. In this section, the term "storm drain system" shall include storm water conduits, storm drain inlets and other storm drain structures, street gutters, channels, watercourses, creeks and lakes.
- B. Sanitary sewer discharge regulations are intended to provide protection of the sanitary sewer system. In this section, "sanitary sewer" shall include any sanitary sewer manhole, clean-out, side sewer or other connection to the sewer system.

1.7 SITE CONDITIONS

- A. Contractor shall have storm drain pollution prevention measure in place and follow this specification during the rainy season (October 15 through April 15) and anytime rain is predicted in the Port of Oakland. It is the responsibility of the Contractor to be prepared for a rain event in the non-rainy season, and to be aware of weather predictions. The Owner is not responsible for informing the contractor of rain predictions.
- B. Sanitary sewer blockage will likely result in a back-up and overflow the storm drain system. The contractor shall immediately notify the project manager or the inspector of record if there is a clogged sanitary sewer.
- C. Contractor shall not allow any non-stormwater to enter the storm drain system. Non-stormwater includes domestic supply water used to wash streets, painting and drywall equipment, or vehicles.

1.8 ENVIRONMENTAL ENFORCEMENT

- A. The Regional Water Quality Control Board (RWQCB), and the Port of Oakland have the authority to enforce, through codified regulations, any portions of this Section that may violate applicable regulations. Agency enforcement may include but is not limited to: citations, orders to abate, bills for cleanup costs and administration, civil suits, and/or criminal charges. Contract compliance action by other jurisdictions shall not be construed to void or suspend any enforcement actions by these or other regulatory agencies.

PART 2 - MATERIALS

2.1 GENERAL

- A. Provide materials as required for execution of the work.

PART 3 - EXECUTION

3.1 DEWATERING

- A. If stormwater or groundwater in site excavations or drilled holes, (e.g., trenches, pits, pier holes, footings), needs to be removed, it shall be made clean by filtering, settling, or other method capable of removing solids from this water prior to discharge to the storm drain system. See Section 019200-2 Section 3.2-3.3 for Groundwater Handling and Disposal.
- B. If excavation water is domestic supply water, or the water is contaminated with a hazardous substance, then the contractor shall dispose of according to guidance from the Owner's Representative.
- C. If the Contractor suspects the presence of contaminated groundwater, or domestic supply water, the Contractor shall immediately notify the Owner's Representative. The Contractor shall not attempt to pump out or treat any material suspected of containing a hazardous material or petroleum product.

3.2 ON-SITE SOILS MOVEMENT AND STORAGE

- A. The Contractor shall implement proven methods to prevent erosion from soils stored on site.

3.3 SITE INGRESS AND EGRESS MANAGEMENT TO PREVENT MUD TRACKING

- A. The Contractor shall ensure that mud is not tracked from the site onto public

roads.

3.4 STORM DRAIN INLET PROTECTION

- B. The Contractor shall protect storm drain inlets from receiving sediment or debris from the construction site with fiber rolls and inlet protection.

3.5 CONSTRUCTION MATERIALS STORAGE

- A. Storage and exposure of raw materials, byproducts, finished products, and hazardous materials containers shall be controlled as described below:
 - 1. All construction materials shall be contained and stored at least ten feet away from storm drain system inlets, catch basins, and curb returns.
 - 2. The Contractor shall not allow any material to enter the storm drain system.
 - 3. At the end of each working day, the Contractor shall collect and prepare for disposal all scrap, debris, and waste material generated by project activities.
 - 4. During wet weather or when rain is in the forecast, the Contractor shall store materials that can flow or be transported by storm water inside a building or under a secured waterproof covering and protected from run-off to prevent accidental release to the storm drain system, (e.g. use sealed debris bins in rainy weather).
 - 5. The Contractor is responsible for ensuring that storage and disposal of all hazardous materials brought on site for this project (e.g., coatings, thinners, solvents, and fuels), and all hazardous waste generated during project activities (e.g., waste oil) is in compliance with all applicable federal, state, and local standards and requirements.
 - 6. Liquid materials shall be stored in secondary containment. The containment shall be designed to hold at least 110% of the volume of the largest stored container.

3.6 CONCRETE AND MORTAR WORK

- A. For concrete or mortar application to be performed on site (if any), the Contractor shall comply with the following provisions:
 - 1. Washing sweepings of exposed aggregate concrete into the street or storm drain system is prohibited. Collect and return sweepings to aggregate base stockpile, or dispose of as construction debris.
 - 2. Do not wash out concrete trucks and equipment into the storm drain system. Whenever possible, perform washout of concrete trucks (if any) and equipment off-site where discharge is controlled.
 - 3. If on-site washout of trucks and equipment is necessary, then the Contractor shall comply with the following procedures:

- a. Locate washout area at least 50 feet from storm drains, open ditches or water bodies, preferably in a dirt area.
- b. Do not allow storm water run-off from the washout area.
- c. Construct a temporary lined pit or bermed area large enough to contain the wash-water and surplus concrete waste.
- d. Wash out concrete waste into the temporary pit where the concrete can set, be broken up, and then disposed of as construction debris. If the volume of water is greater than what will allow concrete to set, allow the wash water to concentrate and/or evaporate, if possible. Otherwise, allow water to settle before filtering it, and then pump to the sanitary sewer under EBMUD permit (as long as the pH is less than hazardous waste limit of 12.5).

3.7 SANITARY SEWER DISCHARGE POINT IDENTIFICATION

- A. If the Contractor will be disposing of water from a settling operation, or any other water approved for sanitary sewer disposal, the Contractor will verify that the manhole used for disposal is a sanitary sewer and not a storm drain. (Note: Do not assume that a manhole is a sanitary sewer, even if the words "sanitary sewer" are embossed on it. Sometimes utility maps and manhole cover designations are incorrect.)

3.8 VEHICLE WASHING AND EQUIPMENT CLEANING

- A. The Contractor shall not perform vehicle cleaning on site, unless a properly designed wash area prevents run-off from entering the storm drain system. Domestic water supply is prohibited from entering the storm drain because it contains chloramines. It can go to the sanitary sewer if the sediment is allowed to settle before discharge and it meets the standards referenced in section 1.03.
- B. The Contractor shall dispose of wash water from the cleaning of non-hazardous water-based coating equipment (such as latex paints or drywall compounds) and tools to the sanitary sewer. Unused latex paint, oil based paint, used or new paint thinner and solvents are prohibited from disposal to the sanitary sewer and the storm drain system. The Contractor shall dispose of these wastes in accordance with federal, state, and local hazardous waste and solid waste regulations.

3.9 BUILDING WASH OR HYDRO-BLASTING WATER MANAGEMENT

- A. Wastewater management for building washing operations is to be used in conjunction with all operations where building exterior surface cleaning generates wash-water.
- B. Wastewater from washing operations is prohibited from discharge to storm drains because it may contain chloramines, cleaning compounds, or materials dislodged from the building surfaces during cleaning (such as leaded paint). Wastewater may

be disposed to landscaped areas or the sanitary sewer under an EBMUD permit as necessary on the condition that contaminant concentrations will not harm the landscape or the sewage treatment facility's operations.

- C. Offsite disposal though may be necessary if contaminants in the wash-water exceed sewer discharge contaminant limits. If cleaning compounds containing surfactants, detergents or other chemicals are used in the cleaning process and there are sludges or residues that need to be disposed of, contact the Owner's Representative for disposal guidance.
- D. Building Washing Wastewater Management Procedures
 - 1. Unpainted Buildings
 - a. Construct a containment system to eliminate wash-water discharge to the storm drain.
 - b. Divert wash-water onto landscaping (preferable) or into the sanitary sewer.
 - c. If high pressure water is used (e.g., hydro-blasting to remove spalled concrete) then settle out the solids using a containment tank, or filter out the solids using filter fabric or other solids removal method.
 - 2. Painted Buildings
 - a. Construct a containment system to eliminate wash-water from draining to the storm drain or the sanitary sewer system.
 - b. Pour, pump or drain the wash-water into a containment tank.
 - c. Use a filter system (e.g., cartridge filters) to remove suspended paint solids. Use settling methods to minimize the amount of solids entering the filter system. This will prevent filter saturation.
 - d. Sample the filtered water before it is discharge to the sanitary sewer. Have the sample analyzed for the 13 priority pollutant metals (antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, zinc) and any other chemicals of concern that could be present to determine whether or not the water is suitable for sanitary sewer discharge.

3.10 SPILL PREVENTION AND CONTROL

- A. The Contractor shall take precautions to prevent accidental spills of pollutants, including hazardous materials brought onsite by the Contractor. However, in the event of a spill, the Contractor shall be held responsible for the following:
 - 1. Immediately contain and prevent leaks and spills of prohibited pollutants from entering the storm drain system. Clean-up the spill and label the container. Store the container in a safe place and contact the Owner's Representative to arrange disposal of the waste. The Contractor shall keep a spill kit on site at all times for this purpose.
 - 2. Contractor shall comply with all federal, state, and local hazardous waste

- requirements. Ensure that no spilled materials are washed into the streets, gutters, storm drains, or creeks.
3. Report any hazardous or unknown material spills immediately to the Owner's Representative. If a spill occurs after hours or on a weekend, call or contact the Oakland Police Department.
- B. The Contractor is responsible for ensuring that its employees and subcontractors (if any) working on site are aware of the location of the campus phone nearest the project site.

3.11 WATER MAIN AND SANITARY SEWER LINE BREAK CONTINGENCY PLAN

- A. If working on or near a water main line, the Contractor shall have a written emergency response plan that states procedures for responding to a break and release of supply water to the storm drain system. The Contractor shall meet the following requirements:
1. Water Main Work
 - a. Determine the direction of water flow if the main were to break.
 - b. Build a containment berm between the work area and the storm drain inlet(s) that the water would flow into. Make the containment structure large enough to hold the water so that it can be pumped to a sanitary sewer.
 - c. Build this containment structure before digging.
 - d. If there is a water main break, pump the water that collects in the containment structure to a sanitary sewer.
 - e. If the containment fails, contact a hazmat crew to prevent chlorinated water from entering the storm drain system by placing dechlorination sodium sulfite tablets in the flow path according to 3.15. Supplies are available from the vendors listed in 3.16.
 - f. Put in place, before digging, sediment control structures upstream of drain inlets and at drain inlets.
 - g. If a break occurs contact the Owner's Representative or inspector of record immediately.
 2. Sanitary Sewer Line Work
 - a. Determine where the sewage will flow if the work could cause a blockage.
 - b. Build a containment structure between the work area and the storm drain inlet(s) that the sewage water would flow into. Make the containment structure large enough to hold the sewage flow so that it can be pumped to a sanitary sewer.
 - c. Build the containment before working on the sewer line.
 - d. If a sewage blockage occurs, pump it to a sanitary sewer, and do not allow it to flow into the storm drain system
 - e. If the containment fails, contact a hazmat crew to prevent chlorinated water from entering the storm drain system by placing dechlorination sodium

sulfite tablets in the sewage according to 3.15. Supplies are available from the vendors listed in 3.16 of this Section.

- f. Put in place, before digging, sediment control structures upstream of drain inlets and at drain inlets.
 - g. If a sewage blockage or spill occurs contact the Owner's Representative or inspector of record immediately.
3. Excavation Work
 - a. Immediately notify the Owner's Representative or inspector of record immediately if a contractor working in the vicinity of sanitary sewer lines causes or discovers a sewage spill, leak or blockage.

3.12 STORM DRAIN SYSTEM CHLORINATION CONTAMINATION PREVENTION

A. General: These procedures describe how to manually dechlorinate discharges of domestic water using sodium thiosulfate solution prior to release into storm sewer systems or receiving waters in accordance with Regional Water Quality Control Board requirements. This procedure is limited to domestic water discharges with a chlorine residual of 2 mg/L or less. Dechlorinating superchlorinated water (chlorine residual of 50-200 mg/L) is not addressed in this procedure.

B. Dechlorination Procedure

1. Dechlorination of chlorinated water discharges is accomplished by the addition of tablets comprised of 90% sodium sulfite to the discharge flow. For discharges from trenches during main breaks, the tablets are placed inside synthetic mesh fabric pockets sewn together in a grid or line (called a "dechlor mat" or "dechlor strip" respectively). The dechlor mat or strip is laid across the flow path or over the storm drain and either weighted down or nailed to the street to keep it in place.
2. In all cases, as the discharged water flows over and around the tablets, chemical is released as the water contacts the tablets, reacting with and destroying the chlorination. The key to the success of this procedure requires effective contact between the flow and the tablets. This is accomplished by ensuring the tablets are well-distributed across the flow path. The tablets must be spaced no more than 4" apart for gravity discharges at ambient pressure. For discharges under pressure (such as pumping), the tablets should be spaced as close together as possible without constricting the flow. The various tablet holder designs are fabricated to ensure that this specification is met.

C. Selection Criteria for Dechlor Mat or Dechlor Strip for Use In Gravity Discharges

1. This decision is ultimately up to the preferences of the user as long as the tablets are well distributed across the flow path. The mats can cover a larger area so if the discharge flow is large and spread out, mats may be

easier to use than multiple strips. Mats are also sized to cover storm drain inlets so if the flow is not well channelized, it may be easier to locate mats over the storm drain(s) the flow is ultimately discharging into rather than laying out strips or mats upstream of this point. Strips are smaller, take up less space in vehicles and multiple strips can be used to cover larger flows so their convenience and flexibility make them the appropriate choice unless some of the conditions described above are encountered.

D. Dechlorination Equipment

1. Dechlor mat (3' x 4') -or-
2. Dechlor strip (3' x 6") -or-
3. Diffuser with tablet chamber -or-
4. Diffuser with mesh tablet holder and Dechlor tablets (45 lb bucket) and DPD Powder-Pop Dispenser

WARNING!

Don't use sodium sulfite with calcium hypochlorite (HTH) or sodium hypochlorite (used to disinfect water distribution system mains or appurtenances). These two chemicals can react when mixed in the presence of water. The reaction can produce heat and both hydrogen and chlorine gas, creating both a potentially toxic and explosive/flammable atmosphere. These chemicals and associated mixing and dispensing equipment must be kept segregated from each other at all times. Should the chemicals become mixed, call 911.

E. Dechlorination For Releases From Trenches During Water Main Breaks

1. Fill Pockets With Tablets: Put one tablet in each pocket of the dechlor mat or strip. If the pocket contains a partially-used tablet, add another tablet only if there is room.
2. Dechlor Mat or Strip in flow Path: Place the dechlor mat or strip across (perpendicular to) the flow path downstream of sediment control devices (e.g., pea gravel bags) and weigh the mat or strip down to ensure that it stays in place. If the flow path is more than 4' wide (width of dechlor mat) when using a dechlor mat or 3' wide (width of dechlor strip) when using a dechlor strip or there is more than one flow path (flow is spreading out in more than one direction), use additional mats to ensure all water from the source is crossing a mat. If the flow is deep (more than 1" above the top of the dechlor mat) and/or the flowrate is very high (>300 GPM), a second mat should be placed downstream of the first mat to ensure adequate dechlorination. Regular spaced strips are recommended for long flow paths.
3. Monitor Mat Or Strip: Check the dechlor mat periodically to ensure some tablet remains in each pocket and that all flow is crossing at least one mat.
4. Clean-up: When the discharge is complete, sweep the flow path to remove any tablet residual and collected sediment.

3.13 DECHLORINATION SUPPLY VENDORS

- A. Fabric holders for sodium sulfite tablets and pea gravel bags (without pea gravel), diffusers and systems for dechlorinating superchlorinated discharges, sodium sulfite tablets or equal. This can be found as listed below.
1. Fabric holders for sodium sulfite tablets and pea gravel bags (without pea gravel) are available from Mike's Products:
 - a. Mike's Products
Mike Kinonen, Owner/Operator
(503) 256-5607
Portland, OR
E-mail: mkpds@hotmail.com
 2. Diffusers and systems for dechlorinating superchlorinated discharges (when disinfecting water mains after maintenance or construction prior to returning to service) made by:
 - a. DAVCO
Dave Cochran, Owner/Operator
2116 N. Main St., Suite J
Walnut Creek, CA 94596
925-934-9333
E-mail: DAVCO2116@aol.com
 3. Sodium sulfite tablets are available from:
 - a. Exceltech or Eltech (product is called D-chlor tablets)
These are sold through USA BlueBook
800-548-1234

3.14 HOUSE KEEPING PRACTICE

- A. The Contractor shall implement the following applicable good housekeeping practices:
1. Store materials that have the potential to be transported to the storm drain system by storm runoff or spillage away from areas of heavy traffic and under cover in a contained area or in sealed waterproof containers.
 2. Use tarps on the ground to collect fallen debris or splatters that could contribute to storm water pollution.
 3. Secure opened bags of powdered materials (if any) that could contribute to storm water pollution and visible dust emissions.
 4. Pick up litter, construction debris, and other waste generated by project activities daily from adjacent areas, including the sidewalk area, gutter, street pavement, and storm drains impacted by the project. All wastes shall be stored in covered containers, disposed of, or recycled immediately.
 5. Clean sidewalks, driveways, or other paved areas within the construction site to eliminate or prevent mud-tracking conditions. Vacuuming, power

sweeping, or manual sweeping is acceptable. Dispose of sweepings in a place that will not pollute the storm drain system. Domestic water may be used but it shall be contained and directed to landscapes or the sanitary sewer. The discharge of wash-water to the storm drain system is prohibited.

6. Inspect vehicles and equipment arriving on-site for leaking fluids, and promptly repair leaking vehicles and equipment. Use drip pans to catch leaks until repairs are made.
7. Avoid spills by handling materials carefully. Keep a stockpile of appropriate spill materials, such as rags or absorbent materials, readily accessible on site. Clean up all spills of materials brought on site for project activities according to Sub-part 3.03.
8. Train employees regularly on good housekeeping practices and procedures. Assign responsibility to specific employees for inspecting good housekeeping, and responding to spills.

3.15 PERSONNEL TRAINING

- A. The Contractor shall train its employees working on the site on the requirements contained in this Section. The Contractor shall document this training in writing. Owner representatives for the site will request to see the training materials and records at the onset of work.
- B. The Contractor shall inform all subcontractors (if any) of the water pollution prevention requirements contained in this specification and include appropriate subcontract provisions to ensure that these requirements are met.

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SECTION 32 11 00

BASE COURSES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Aggregate base.
- B. Cement treated base.
- C. Lime stabilization.

1.2 RELATED SECTIONS

- A. Section 31 20 00 – Earth Moving
- B. ~~Section 32 12 16 – Asphalt Paving~~
- C. Section 32 13 13 – Concrete Paving

1.3 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. "Geotechnical Investigation Venetia Valley K-8 School", prepared by Miller Pacific Engineering Group, dated April 27, 2017.
- C. ASTM:
 - 1. D 3740, Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
 - 2. E 329, Specification for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
 - 3. E 548, Guide for General Criteria Used for Evaluating Laboratory Competence.
 - 4. 2015 Caltrans Standard Specifications Sections 24, 25, 26, and 27.

1.4 DEFINITIONS

- A. Geotechnical Testing Agency: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock definition testing, as documented according to ASTM D 3740 and ASTM E 548.

- B. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material $\frac{3}{4}$ -cubic yards or more in volume that when tested by an independent geotechnical testing agency, according to ASTM D 1586, exceeds a standard penetration resistance of 100 blows/2-inches.
- C. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man made stationary features constructed above or below grade.
- D. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, base or topsoil materials.

1.5 SUBMITTALS

- A. Submit material certificates signed by the material producer and the Contractor, certifying that that each material item complies with, or exceeds the specified requirements.

1.6 QUALITY ASSURANCE

- A. Conform all work and materials to the recommendations or requirements of the Geotechnical Report and meet the approval of the Geotechnical Consultant prior to the use of lime or cement treated base.
- B. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM D 1557.
- C. Perform installation of base materials under the observation of the Geotechnical Consultant. Materials placed without approval of the Geotechnical Consultant will be presumed to be defective and, at the discretion of the Geotechnical Consultant, shall be removed and replaced at no cost to the Owner. Notify the Geotechnical Consultant at least 24-hours prior to commencement of base material installation and at least 48 hours prior to testing.
- D. Do not mix or place cement treated base when the temperature is below 36 degrees F or when the ground is frozen.
- E. Finish surface of material to be stabilized prior to lime treatment shall be as specified in Section 24-1.04 of Caltrans Standard Specifications.
- F. Finish surface of the stabilized material after lime treatment shall be as specified in Section 24-1.08 of Caltrans Standard Specifications.
- G. Finish surface of cement treated base shall be as specified in Section 27 of Caltrans Standard Specifications.
- H. Do not project the finish surface of aggregate subbase above the design subgrade.

- I. Finish grade tolerance at completion of base installation: +0.05 feet.

1.7 PROJECT CONDITIONS

- A. Protect open excavations, trenches, and the like with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.
- B. Temporarily stockpile material in an orderly and safe manner and in a location approved by the Owner.
- C. Provide dust and noise control in conformance with Specification Section 31 25 00 "Erosion and Sediment Control".

PART 2 - PRODUCTS

2.1 AGGREGATE SUBBASE:

- A. Material: Caltrans Standard Specification Section 25.
 1. Class 2: Section 25-1.02.

2.2 AGGREGATE BASE

- A. Material: Caltrans Standard Specification Section 26.
 1. Class 2: Section 26-1.02.

PART 3 - EXECUTION

3.1 GENERAL

1. Contractor shall notify the Geotechnical Engineer 72 hours prior to import of materials or use of on-site materials to permit time for sampling, testing, and evaluation of the proposed materials.
2. Placement and compaction of material by flooding, ponding, or jetting will not be permitted.

3.2 WET WEATHER CONDITIONS

- A. Do not place or compact subgrade if above optimum moisture content.
- B. If the Geotechnical Consultant allows work to continue during wet weather conditions, conform to supplemental recommendations provided by the Geotechnical Consultant.

3.3 AGGREGATE SUBBASE

- A. Spreading and Compacting: Section 25-1.03 Caltrans Standard Specifications.

3.4 AGGREGATE BASE

- A. Watering, Spreading and Compacting: Section 26-1.03 of Caltrans Standard Specifications.

3.5 CEMENT TREATED BASE

- A. Cement treated base shall be as follows: Proportioning and Mixing Plant-Mixed: Section 27 of Caltrans Standard Specifications.

3.6 LIME STABILIZED SOIL

- A. Performing the stabilization shall conform to Section 24-2 of Caltrans Standard Specifications and the following:
 - 1. Add lime in the amount specified by the Geotechnical Consultant.
 - 2. Lime treat subgrade soils from back of curb to back of curb to a depth specified by the Geotechnical Consultant.
 - 3. Mix in two mixing periods, both with the tines lowered to the same depth. Both mixing periods shall be monitored and verified by the Geotechnical Consultant. The second mixing shall occur at about 24 hours after the initial mixing.
 - 4. Compact and grade the lime mixed subgrade immediately after the second mixing.
 - 5. Compact the lime treated subgrade to 93 percent as determined by ASTM D1557.
 - 6. After application of the curing seal, do not allow traffic on the lime treated material for a period of 7 days.
 - 7. Proof-roll the stabilized subgrade after compacting to confirm that a non-yielding surface has been achieved. Yielding areas, if any, shall be mitigated. Mitigation could consist of over-excavation, utilization of stabilization fabric, or chemical treatment. Each case shall be addressed individually in the field by the Geotechnical Consultant.

3.7 DISPOSAL

- A. Lawfully dispose of all unsuitable and excess or surplus material off-site at no cost to the Owner.

END OF SECTION

SECTION 32 13 13

CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Furnishing, placing, spreading, compacting and shaping portland cement concrete pavement with undoweled transverse weakened plane joints, for vehicular traffic.
- B. Form construction and use in placing portland cement concrete pavement.
- C. Joints for portland cement concrete pavement.
- D. Finishing portland cement concrete pavement.
- E. Curing and protecting portland cement concrete pavement.

1.2 RELATED SECTIONS

- A. 31 20 00, Earth Moving
- B. ~~32 05 23, Concrete Finishes for Site Work~~
- C. 32 11 00, Pavement Base Course
- D. 32 13 18, Cement and Concrete for Exterior Improvements

1.3 RELATED DOCUMENTS

- A. Geotechnical Report: "Geotechnical Investigation Venetia Valley K-8 School", prepared by Miller Pacific Engineering Group, dated April 27, 2017.
- B. AASHTO Standard Specifications
 - 1. T132: Standard Method of Test for Tensile Strength of Hydraulic Cement Mortars
- C. ASTM Standards
 - 1. D36: Standard Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)
 - 2. A615: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 - 3. A706: Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.
 - 4. A775: Standard Specification for Epoxy Coated Steel Reinforcing Bars.
 - 5. A934: Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
 - 6. A996: Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement

7. C94: Standard Specification for Ready-Mixed Concrete
8. C603: Standard Test Method for Extrusion Rate and Application Life of Elastomeric Sealants
9. C639: Standard Test Method for Rheological (Flow) Properties of Elastomeric Sealants
10. C661: Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer
11. C679: ASTM C679-15 Standard Test Method for Tack-Free Time of Elastomeric Sealants
12. C719: Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)
13. C793: Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants
14. C881: Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
15. D412: Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
16. D1640: Standard Test Methods for Drying, Curing, or Film Formation of Organic Coatings
17. D2628: Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.
18. D2835: Standard Specification for Lubricant for Installation of Preformed Compression Seals in Concrete Pavements.
19. D3963: Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars.
20. D6690: Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

D. Caltrans Standard Specifications, 2015

1. Section 10, General
2. Section 40, Concrete Pavement
3. Section 52, Reinforcement
4. Section 95, Epoxy

E. Caltrans Standard Plans:

1. Plan P1: Jointed Plan Concrete Pavement – New Construction
2. Plan P10: Concrete Pavement Dowel Bar Details

1.4 DEFINITIONS

- A. AASHTO: American Association of State Highway and Transportation Officials
- B. ASTM: American Society for Testing and Materials
- C. Caltrans: State of California, Department of Transportation

1.5 QUALITY ASSURANCE

- A. Testing Agency: Contractor will engage a qualified independent testing agency to perform field inspections and tests and to prepare test reports.

1. Testing agency will conduct and interpret tests and state in each report whether tested work complies with or deviates from specified requirements.
- B. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.
- C. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C94 requirements for production facilities and equipment.
- D. Installer Qualification: An experienced installer who has completed pavement work similar in material, design and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- E. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source.

1.6 SUBMITTALS

- A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.
- B. Design Mixes: For each concrete pavement mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results or other circumstances warrant adjustments.
- C. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements.
 1. Cementitious materials and aggregates
 2. Steel reinforcement and reinforcement accessories
 3. Admixtures
 4. Curing compound
 5. Applied finish material
 6. Bonding agent or adhesive
 7. Joint filler
 8. Joint Sealant
 9. Tie Bars
 10. Epoxy
 11. Backer Rods

PART 2 - PRODUCTS

2.1 PORTLAND CEMENT CONCRETE

- A. Type II in accordance with Section 32 13 18, Cement and Concrete for Exterior Improvements. Fly ash shall be Class F.

2.2 BASE MATERIAL

- A. In accordance with Section 32 11 00, Pavement Base Course.

2.3 TIE BARS

- A. Deformed reinforcing steel bars conforming to the requirements of ASTM Designation A615, Grade 40 or 60
- B. Epoxy-coat in accordance with Caltrans Standard Specification Section 52-2.02, Epoxy-Coated Reinforcement, except bars must comply with ASTM A706; ASTM A996; or ASTM A615, Grade 40 or 60.
- C. Do not bend tie bars.

2.4 EPOXY

- A. Bond tie bars to existing concrete with epoxy resin in accordance with Caltrans Standard Specification Section 95-1.02D, Epoxy Adhesive for Bonding Freshly Mixed Concrete to Hardened Concrete.

2.5 SILICONE JOINT SEALANT

- A. Furnish low modulus silicone joint sealant in a one-part silicone formulation. Do not use acid cure sealants. Compound to be compatible with the surface to which it is applied and conform to the following requirements:

Specification	Test Method	Requirement
Tensile stress, 150% elongation, 7-day cure at 77° ± 1°F and 45% to 55% Relative Humidity	ASTM D412 (Die C)	45 psi max.
Flow at 77° ± 1°F	ASTM C639 ^a	Shall not flow from channel
Extrusion Rate at 77° ± 1°F	ASTM C603 ^b	75-250 g per min.
Specific Gravity	ASTM D792 Method A	1.01 to 1.51
Durometer Hardness, at 0°F, Shore A, cured 7 days at 77° ± 1°F	ASTM C661	10 to 25
Ozone and Ultraviolet Resistance, after 5000 hours	ASTM C793	No chalking, cracking or bond loss
Tack free at 77° ± 1°F and 45% to 55% Relative Humidity	ASTM C679	Less than 75 minutes
Elongation, 7 day cure at 77° ± 1°F and 45% to 55% Relative Humidity	ASTM D412 (Die C)	500 percent min.
Set to Touch, at 77° ± 1°F and 45% to 55% Relative Humidity	ASTM D1640	Less than 75 minutes
Shelf Life, from date of shipment	—	6 months min.
Bond, to concrete mortar-concrete briquets, air cured 7 days at 77° ± 1°F	AASHTO T132 ^c	50 psi min.
Movement Capability and Adhesion, 100% extension at 0°F after air cured 7 days at 77° ± 1°F, and followed by 7 days in water at 77° ± 1°F	ASTM C719 ^d	No adhesive or cohesive failure after 5 cycles

Notes:

- a. ASTM Designation: C639 Modified (15 percent slope channel A).
- b. ASTM Designation: C603, through 1/8 inches opening at 50 psi.
- c. Mold briquets in conformance with the requirements in AASHTO Designation: T132, sawed in half and bonded with a 1/16 inches maximum thickness of sealant and tested in conformance with the requirements in AASHTO Designation: T132. Briquets shall be dried to constant mass at 212 ± 10°F.
- d. Movement Capability and Adhesion: Prepare 12 inch x 1 inch x 3 inch concrete blocks in conformance with the requirements in ASTM Designation: C719. A sawed face shall be used for bond surface. Seal 2 inch of block leaving 1/2 inches on each end of specimen unsealed. The depth of sealant shall be 3/8 inches and the width 1/2 inches.

B. Formulate the silicon joint sealant to cure rapidly enough to prevent flow after application on grades of up to 15 percent.

C. Furnish to the Contractor a Certificate of Compliance. Accompany certificate with a certified test report of the results of the required tests performed on the sealant material within the previous 12 months prior to proposed use. Provide the certificate and accompanying test report for each lot of silicone joint sealant prior to use on the project.

2.6 ASPHALT RUBBER JOINT SEALANT

A. Conform to the requirements of ASTM Designation: D6690 as modified herein or to the following:

1. Provide a mixture of paving asphalt and ground rubber. Ground rubber to be vulcanized or a combination of vulcanized and de-vulcanized materials ground so that 100 percent will pass a No. 08 sieve and contain not less than 22 percent ground rubber, by mass. Modifiers may be used to facilitate blending.
 2. The Ring and Ball softening point shall be 135°F minimum, when tested in conformance with the requirements in ASTM D36.
 3. Provide asphalt rubber sealant material capable of being melted and applied to cracks and joints at temperatures below 400°F.
- B. The penetration requirements of Section 4.2 of ASTM Designation: D6690 do not apply. The required penetration at 77°F, 5 oz, 5s, shall not exceed 120.
- C. The resilience requirements of Section 4.5 of ASTM Designation: D6690 do not apply. The required resilience, when tested at 77°F, shall have a minimum of 50 percent recovery.
- D. Accompany each lot of asphalt rubber joint sealant shipped to the job site, whether as specified herein or conforming to the requirements of ASTM Designation D6690, as modified herein, by a Certificate of Compliance, storage and heating instructions and precautionary instructions for use.
- E. Heat and place in conformance with the manufacturer's written instructions and the details shown on the Plans. Provide manufacturer's instructions to the Contractor. Do not place when the pavement surface temperature is below 50 °F.

2.7 PREFORMED COMPRESSION JOINT SEALANT

- A. Material: ASTM Designation: D2628.
1. Number of cells: 5 or 6.
 2. Lubricant Adhesive: ASTM Designation D2835.
 3. Install compression seals along with lubricant adhesive according to the manufacturer's recommendations. Submit manufacturer's recommendations to the Contractor.
- B. Accompany each lot of compression seal and lubricant adhesive by a Certificate of Compliance, storage instructions and precautionary instructions for use. Also submit the manufacturer's data sheet with installation instructions and recommended model or type of preformed compression seal for the joint size and depth as shown on the Plans. Show evidence that the selected seal is being compressed at level between 20 and 50 percent at all times for the joint width and depth shown on the Plans.

2.8 BACKER RODS

- A. Provide backer rods that have a diameter prior to placement at least 25 percent greater than the width of the saw cut after sawing and are expanded, crosslinked, closed-cell polyethylene foam that is compatible with the joint sealant so that no bond, adverse reaction occurs between the rod and sealant. In no case use a hot pour sealant that will melt the backer rod. Submit a manufacturer's data sheet verifying that the backer rod is compatible with the sealant to be used.

2.9 SLIP RESISTIVE AGGREGATE FINISH

- A. Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

PART 3 - EXECUTION

3.1 WATER SUPPLY

- A. Provide water supply in accordance with Caltrans Standard Specification Section 10-6, Watering.

3.2 SUBGRADE

- A. Prepare subgrade in accordance with Caltrans Standard Specification Section 40-1.03F, Placing Concrete.

3.3 SOIL STERILANT

- A. Furnish and apply to areas indicated in accordance with Section 31 20 00, Earth Moving.

3.4 PLACING

- A. Prepare concrete in accordance with Caltrans Standard Specification Section 40-1.03F, Placing Concrete.

3.5 SPREADING COMPACTING AND SHAPING

- A. Conform to the following:
 - 1. Stationary Side Form Construction: In accordance with Caltrans Standard Specification Section 40-1.03F(4), Stationary Side-Form Construction.
 - 2. Slip Form Construction: In accordance with Caltrans Standard Specification Section 40-1.03F(4), Slip Form Construction.

3.6 INSTALLING TIE BARS

- A. Install at longitudinal contact joints, longitudinal weakened plane joints, and transverse contact joints as shown on the Plans. In no case, shall any consecutive width of new portland cement concrete pavement tied together with tie bars exceed 50 feet. In no case shall tie bars be used at a joint where portland cement concrete and asphalt concrete pavements abut.
- B. Tie bars shall be installed at longitudinal joints by one of the 3 following methods:
 - 1. Drilling and bonding in conformance with the details shown on the Plans. Provide a two-component, epoxy-resin, conforming to the requirements of ASTM Designation: C881, Type V. Grade 3 (Non-Sagging), Class shall be as follows:

<u>Temperature of Concrete Resin</u>	<u>Required Class of Epoxy</u>
Lower than 40° F	A
40° F through 60° F	B
Above 60° F	C

2. Provide, at least 7 days prior to start of work, a Certificate of compliance and a copy of the manufacturer's recommended installation procedure. The drilled holes shall be cleaned in accordance with the epoxy manufacturer's instructions and shall be dry at the time of placing the epoxy and tie bars. Immediately after inserting the tie bars into the epoxy, the tie bars shall be supported as necessary to prevent movement during the curing and shall remain undisturbed until the epoxy has cured a minimum time as specified by the manufacturer. Tie bars that are improperly bonded, as determined by the Contractor, will be rejected. If rejected, adjacent new holes shall be drilled, as directed by the Contractor, and new tie bars shall be placed and securely bonded to the concrete. All work necessary to correct improperly bonded tie bars shall be performed at the Contractor's expense.
3. Insert the tie bars into the plastic slip-formed concrete before finishing the concrete. Inserted tie bars shall have full contact between the bar and the concrete. When tie bars are inserted through the pavement surface, the concrete over the tie bars shall be reworked and refinished to such an extent that there is no evidence on the surface of the completed pavement that there has been any insertion performed. Any loose tie bars shall be replaced by drilling and grouting into place with epoxy as described in method 1 above at the Contractor's expense.
4. By using threaded dowel splice couplers fabricated from deformed bar reinforcement material, free of external welding or machining. Threaded dowel splice couplers shall be accompanied by a Certificate of Compliance and installation instructions. Installation of threaded dowel splice couplers shall conform to the requirements of the manufacturer's recommendations.

3.7 JOINTS

A. Construct joints in accordance with Caltrans Standard Specification Section 40-1.03B, Joints, except that tie bars shall be as specified under Part 1, Materials.

1. Construction Joints: In accordance with Caltrans Standard Specification Section 40-1.03B(2), Construction Joints.
 - a. Construct a construction joint at the end of each day's work, or where concrete placement is interrupted for more than 30 minutes, to coincide with the next weakened plane joint location.
 - b. If sufficient concrete has not been mixed to form a slab to match the next contraction joint, when an interruption occurs, the excess concrete shall be removed and disposed of back to the last preceding joint. The cost of removing and disposing of any excess concrete shall be at the Contractor's expense. Any excess material shall become the property of the Contractor and shall be properly disposed of.
 - c. A metal or wooden bulkhead (header) shall be used to form the joint. The bulkhead shall be designed to accommodate the installation of tie bars.

2. Contraction Joints: In accordance with Caltrans Standard Specification Section 40-1.03B (3), Contraction Joints, except that the insert method of forming joints in pavement shall not be used.

3.8 FINISHING

- A. Finish concrete in accordance with Specification Section 32 05 23, Concrete Finishes for Site Work.

3.9 CURING

- A. Cure concrete in accordance with Caltrans Standard Specification Section 40-1.03I, Curing.

3.10 SEALING JOINTS

- A. Liquid Joint Sealant Installation.

1. The joint sealant detail for transverse and longitudinal joints, as shown on the Plans, shall apply only to weakened plane joints. Construct weakened plane joints by the sawing method. Should grinding or grooving be required over or adjacent to any joint after sealant has been placed, completely remove the joint material and disposed of, and replace at the Contractor's expense. Recess sealant below the final finished surface as shown on the Plans.
2. At the Contractor's option, transverse weakened plane joints shall be either Type DSC or Type SSC as shown on the Plans. Longitudinal weakened plane joints shall be Type SSC only as shown on the Plans.
3. Seven days after the concrete pavement placement and not more than 4 hours before placing backer rods and joint sealant materials, clean the joint walls by the dry sand blast method and other means as necessary to completely remove from the joint all objectionable material such as soil, asphalt, curing compound, paint and rust. After cleaning the joint, remove all traces of sand, dust and loose material from and near the joint for a distance along the pavement surfaces of at least 2 inch on each side of the joint by the use of a vacuum device. Remove surface moisture at the joints by means of compressed air or moderate hot compressed air or other means approved means. Do not use drying procedures that leave a residue or film on the joint wall. Sandblasting equipment shall have a maximum nozzle diameter size of $1/4 \pm 1/32$ inches and a minimum pressure of 90-psi.
4. Install backer rod as shown on the Plans. Provide an expanded, closed-cell polyethylene foam backer rod that is compatible with the joint sealant so that no bond or adverse reaction occurs between the rod and sealant. Install backer rod when the temperature of the portland cement concrete pavement is above the dew point of the air and when the air temperature is 40°F or above. Install backer rod when the joints to be sealed have been properly patched, cleaned and dried. Do not use a method of placing backer rod that leave a residue or film on the joint walls.
5. Immediately after placement of the backer rod, place the joint sealant in the clean, dry, prepared joints as shown on the Plans. Apply the joint sealant by a mechanical device with a nozzle shaped to fit inside the joint to introduce the sealant from inside the joint. Apply adequate pressure to the

sealant to ensure that the sealant material is extruded evenly and that full continuous contact is made with the joint walls. After application of the sealant recess the surface of the sealant as shown on the Plans.

6. Any failure of the joint material in either adhesion or cohesion of the material will be cause for rejection of the joint. Conform the finished surface of joint sealant to the dimensions and allowable tolerances shown on the Plans. Rejected joint materials or joint material whose finished surface does not conform to the dimensions shown on the Plans shall be repaired or replaced, at the Contractor's expense, with joint material that conforms to the requirements.
7. After each joint is sealed, remove all surplus joint sealer on the pavement surface. Traffic shall not be permitted over the sealed joints until the sealant is tack free and set sufficiently to prevent embedment of roadway debris into the sealant.

B. Preformed Compression Joint Seal Installation

1. The compression seal alternative joint detail for transverse and longitudinal joints, as shown on the Plans, shall apply only to weakened plane joints. Construct weakened plane joints by the sawing method. Should grinding or grooving be required over or adjacent to any joint after the compression seal has been placed, completely remove the joint materials and disposed of, and replace at the Contractor's expense. Compression seal shall be recessed below the final finished surface as shown on the Plans.
2. At the Contractor's option, transverse weakened plane joints shall be either Type DSC or Type SSC as shown on the Plans. Longitudinal weakened plane joints shall be Type SSC only as shown on the Plans.
3. Seven days after the concrete pavement placement and not more than 4 hours before placing preformed compression joint seals, clean the joint walls by the dry sand blast method and other means as necessary to completely remove from the joint all objectionable material such as soil, asphalt, curing compound, paint and rust. After cleaning the joint, remove all traces of sand, dust and loose material from and near the joint for a distance along the pavement surfaces of at least 50 mm on each side of the joint by the use of a vacuum device. Remove surface moisture at the joints by means of compressed air or moderate hot compressed air or other means. Do not use drying procedures that leave a residue or film on the joint wall. Sandblasting equipment shall have a maximum nozzle diameter size of $1/4 \pm 1/32$ inches and a minimum pressure of 90 psi.

3.11 PROTECTING CONCRETE PAVEMENT

- A. Protect pavement in accordance with Caltrans Standard Specification Section 40-1.03J Protecting Concrete Pavement.

END OF SECTION

SECTION 32 13 18

CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

- A. Section 31 20 00, Earth Moving
- B. ~~Section 32 12 16, Asphalt Paving~~
- C. Section 32 13 13, Concrete Pavement
- D. Section 32 13 18, Cement and Concrete for Exterior Improvements
- E. ~~Section 32 13 75, Concrete Curbs and Gutters~~

1.3 RELATED DOCUMENTS

- A. Geotechnical Report: "Geotechnical Investigation Venetia Valley K-8 School", prepared by Miller Pacific Engineering Group, dated April 27, 2017.

B. ASTM Standards

1. A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
2. A1064, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
3. C94, Standard Specification for Ready-mixed Concrete
4. C150, Standard Specification for Portland Cement
5. C260, Standard Specification for Air-Entraining Admixtures for Concrete
6. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
7. C494, Standard Specification for Chemical Admixtures for Concrete.
8. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for use in Portland Cement
9. C1017, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
10. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
11. D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

C. Caltrans Standard Specifications, 2015

1. Section 51: Concrete Structures
2. Section 73: Concrete Curbs and Sidewalks
3. Section 90: Concrete

1.4 DEFINITIONS

- A. ASTM: American Society for Testing and Materials

1.5 SUBMITTALS

- A. Follow submittal procedures outlined in Section 01 10 00, Supplemental General Requirements.
- B. Concrete Mix Design: Have all concrete mixes designed by a testing laboratory and approved by the Consulting Engineer. Conform all mixes to the applicable building code requirement, regardless of other minimum requirements listed herein or on the Plans. Submit mix designs for review before use. Show proportions and specific gravities of cement, fine and coarse aggregate, and water and gradation of combined aggregates.
- C. Reinforcing Steel Shop-Drawings

1.6 QUALITY ASSURANCE

- A. Concrete shall be subject to quality assurance in accordance with Section 90 of the Caltrans Standard Specifications.
1. Slump tests: Have available, at job site, equipment required to perform slump tests. Make one slump test for each cylinder sample, from same concrete batch. Allowable maximum slump shall be 4 inches for walls and 3 inches for slabs on grade and other work.

B. Certifications:

1. Provide Contractor at the time of delivery with certificates of compliance signed by both Contractor and Supplier containing the following statements:
 - a. Materials contained comply with the requirements of the Contract Documents in all respects.
 - b. Proportions and mixing comply with the design mix approved by the Consulting Engineer. Design mix shall have been field tested in accordance with the herein requirements of the Caltrans Standard Specifications and produces the required compressive strength under like conditions.
 - c. Statement of type and amount of any admixtures.
2. Provide Contractor, at time of delivery, with certified delivery ticket stating volume of concrete delivered and time of mixing, or time of load-out in case of transit mixers.

1.7 DESIGNATION

- A. General: Whenever the 28 day compressive strength is designated herein or on the Plans is 3,600 psi or greater, the concrete shall considered to be designated by compressive strength. The 28 day compressive strength shown herein or on the plans which are less than 3,600 psi are shown for design information only and are not considered a requirement for acceptance of the concrete. Whenever the concrete is designated by class or as minor concrete herein or on the Plans, the concrete shall contain the cement per cubic yard shown in Section 90-2 of the Caltrans Standard Specifications.
- B. Unless specified otherwise herein or on the Plans, portland cement concrete for curbs, gutters, sidewalks and their appurtenances such as island paving, curb ramps and driveways, shall be minor concrete as specified in Section 90-2 of the Caltrans Standard Specifications.

PART 2 - PRODUCTS

2.1 PORTLAND CEMENT

- A. General: Type II cement conforming to the requirements of ASTM C150. Contractor may substitute pozzolan for portland cement in amounts up to 15% of the required mix unless high early strength concrete is specified. Pozzolan shall consist of Class F Fly Ash meeting the requirements of ASTM C618.
- B. Color: Provide a coloring equivalent to ¼ pound of lampblack per cubic yard. Add to the concrete at the central mixing plant.

2.2 AGGREGATE AND AGGREGATE GRADATION

- A. General: Fine and coarse aggregates shall be ¾ inch maximum size; clean and crushed aggregate free of materials which may cause staining. Aggregates shall conform to the requirements of section 90-1.02C of the Caltrans Standard Specifications.

- B. Aggregate Size and Gradation: Conform to the requirements of section 90-1.02C(4)(d) of the Caltrans Standard Specifications for 1 inch maximum combined aggregate.

2.3 WATER

- A. General: Water shall be clean, free from injurious amounts of oil, alkali, organic matter, or other deleterious material, and not detrimental to concrete per ASTM C94. Water shall conform to the requirements of section 90-1.02D of the Caltrans Standard Specifications, for mixing and curing portland cement concrete and for washing aggregates.

2.4 CHEMICAL ADMIXTURES

- A. Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain no more than 0.1 percent water-soluble chloride ions by mass of cementitious material. Admixtures shall conform to the requirements of section 90-1.02E of the Caltrans Standard Specifications and as noted herein or on the Plans.
1. Air-Entraining Admixture: ASTM C260/C260M
 2. Water-Reducing Admixture: ASTM C494/C494M, Type A
 3. Retarding Admixture: ASTM C494/C494M, Type B
 4. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D
 5. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F
 6. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G
 7. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II

2.5 CLASSIFICATION OF PORTLAND CEMENT CONCRETE

- A. Unless specified otherwise herein or on the Plans, portland cement concrete for the following items shall be designated as follows:
1. Curbs, Gutters, and Sidewalks: Minor concrete.
 2. Cast in Place Concrete Pipe: The concrete shall consist of a minimum of 564 pounds of portland cement per cubic yard of concrete.
 3. Thrust Blocks: The concrete shall have a minimum compressive strength of 3,000 psi.
 4. Sign and Fence Footings: The concrete shall consist of a minimum of 376 pounds of portland cement per cubic yard of concrete.
 5. Water, Storm, and Sanitary Structures: The concrete shall consist of a minimum of 564 pounds of portland cement per cubic yard of concrete.

2.6 EXPANSION JOINT MATERIAL

- A. Material for expansion joints in portland cement concrete improvements shall be premolded expansion joint fillers conforming to the requirements of ASTM D1751. Expansion joint material shall be shaped to fit the cross section of the concrete prior to being placed. Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site. Unless specified otherwise herein or on the Plans, expansion joint thickness shall be as follows:
1. Concrete Slope Protection, Gutter Lining, Ditch Lining and Channel Lining: ½ inch
 2. Structures: As indicated

2.7 REINFORCEMENT AND DOWELS

- A. Bar reinforcement for concrete improvements shall be deformed steel bars of the size or sizes called for on the plans conforming to the requirements of ASTM A615 for Grade 60 bars. Size and shape for bar reinforcement shall conform to the details shown or called for on the Plans. Substitution of wire mesh reinforcement for reinforcing bars will not be allowed.
- B. Slip dowels, where noted or called for on the Plans or detail drawings shall be smooth billet-steel bars as designated and conforming to the requirements of ASTM A615 for Grade 60 bars. Ends of bars inserted in new work shall be covered with a cardboard tube sealed with cork; no grease or oil shall be used.
- C. Mesh for reinforcement for concrete improvements shall be cold drawn steel wire mesh of the size and spacing called for on the plans conforming to the requirements of ASTM A1064. Size and extent of mesh reinforcement shall conform to the details shown or called for on the plans.
- D. Tie wire for reinforcement shall be eighteen (18) gauge or heavier, black, annealed conforming to the requirements of ASTM A1064.
- E. Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site.

2.8 CURING AND SEALING MATERIALS

- A. Curing Compounds:
 - 1. Concrete surface repellent-vertical and/or flatwork: Repello surface treatment, invisible chemical treatment barrier system.
 - 2. Curing and sealing-exterior: Colorcure concrete cureseal manufactured by L.M. Scofield Company or approved equal. Color-matched, water-based curing and sealing compound that complies with ASTM C309.
 - 3. Color Conditioned Decorative Portland Cement Concrete: LITHOCHROME colorwax manufactured by L.M. Scofield Company or approved equal. Color-matched, water-based curing and sealing compound that complies with ASTM C309.

2.9 FORMS

- A. Conform to the requirements of Section 73-1.03C and Section 90-1.03B(5) of the Caltrans Standard Specifications.
- B. Tolerance: Not to deviate more than ¼ inch in 10 feet in grade and alignment.

2.10 PRECAST CONCRETE STRUCTURES

- A. Conform to the following Sections of Caltrans Standard Specifications:
 - 1. 51-7, Minor Structures
 - 2. 70-5.02, Flared End Sections

2.11 CONCRETE VEHICULAR PAVEMENT

- A. General: See Section 32 13 13, Concrete Pavement.

PART 3 - EXECUTION

3.1 STRUCTURAL EXCAVATION

- A. Structural excavation may be either by hand, or by machine and shall be neat to the line and dimension shown or called for on the plans. Excavation shall be sufficient width to provide adequate space for working therein, and comply with CAL-OSHA requirements.
- B. Where an excavation has been constructed below the design grade, refill the excavation to the bottom of the excavation grade with approved material and compact in place to 95% of the maximum dry density as determined by ASTM D1557.
- C. Remove surplus excavation material remaining upon completion of the work from the job site, or condition it to optimum moisture content and compact it as fill or backfill on the site.

3.2 BRACING AND SHORING

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

3.3 PLACING CONCRETE FORMS

- A. Form concrete improvements with a smooth and true upper edge. Side of the form with a smooth finish shall be placed next to concrete. Construct forms rigid enough to withstand the pressure of the fresh concrete to be placed without any distortion.
- B. Thoroughly clean all forms prior to placement and coat forms with an approved form oil in sufficient quantity to prevent adherence of concrete prior to placing concrete.

- C. Carefully set forms to the alignment and grade established and conform to the required dimensions. Rigidly hold forms in place by stakes set at satisfactory intervals. Provide sufficient clamps, spreaders and braces to insure the rigidity of the forms.
- D. Provide forms for back and face of curbs, lip of gutters and edge of walks, valley gutters or other surface slabs that are equal to the full depth of the concrete as shown, noted or called for on the Plans. On curves and curb returns provide composite forms made from benders or thin planks of sufficient ply to ensure rigidity of the form.

3.4 PLACING STEEL REINFORCEMENT

- A. Bars shall be free of mortar, oil, dirt, excessive mill scale and scabby rust and other coatings of any character that would destroy or reduce the bond. All bending shall be done cold, to the shapes shown on the plans. The length of lapped splices shall be as follows:
 - 1. Reinforcing bars No. 8, or smaller, shall be lapped at least 45 bar diameters of the smaller bar joined, and reinforced bars Nos. 9, 10, and 11 shall be lapped at least 60 bar diameters of the smaller bars joined, except when otherwise shown on the plans.
 - 2. Splice locations shall be made as indicated on the plans.
- B. Accurately place reinforcement as shown on the plans and hold firmly and securely in position by wiring at intersections and splices, and by providing precast mortar blocks or ferrous metal chairs, spacers, metal hangers, supporting wires, and other approved devices of sufficient strength to resist crushing under applied loads. Provide supports and ties of such strength and density to permit walking on reinforcing without undue displacement.
- C. Place reinforcing to provide the following minimum concrete cover:
 - 1. Surfaces exposed to water: 4 inches.
 - 2. Surfaces poured against earth: 3 inches.
 - 3. Formed surfaces exposed to earth or weather: 2 inches.
 - 4. Slabs, walls, not exposed to weather or earth: 1 inch.
- D. Minimum spacing, center of parallel bars shall be two and one half (2 ½) times the diameter of the larger sized bar. Accurately tie reinforcing securely in place prior to pouring concrete. Placing of dowels or other reinforcing in the wet concrete is not permitted.

3.5 MIXING AND TRANSPORTING PORTLAND CEMENT CONCRETE

- A. Transit mix concrete in accordance with the requirements of ASTM Designation C94. Transit mix for not less than ten (10) minutes total, not less than three (3) minutes of which shall be on the site just prior to pouring. Mix continuous with no interruptions from the time the truck is filled until the time it is emptied. Place concrete within one hour of the time water is first added.
- B. Do not hand mix concrete for use in concrete structures.

3.6 PLACING PORTLAND CEMENT CONCRETE

- A. Thoroughly wet subgrade when concrete is placed directly on soil. Remove all standing water prior to placing concrete.
- B. Do not place concrete until the subgrade and the forms have been approved.
- C. Convey concrete from mixer to final location as rapidly as possible by methods that prevent separation of the ingredients. Deposit concrete as nearly as possible in final position to avoid re-handling.
- D. Place and solidify concrete in forms without segregation by means of mechanical vibration or by other means as approved by the Owner's Representative. Continue vibration until the material is sufficiently consolidated and absent of all voids without causing segregation of material. The use of vibrators for extensive shifting of fresh concrete will not be permitted.
- E. Concrete in certain locations may be pumped into place upon prior approval by the Owner's Representative. When this procedure requires redesign of the mix, such redesign shall be submitted for approval in the same manner as herein specified for approval of design mixes.

3.7 PLACING ACCESSORY MATERIALS

- A. Place water stops and other items required to be embedded in of portland cement concrete structures at locations shown or required in accordance with Section 51-2.04 of the Caltrans Standard Specifications unless otherwise specifically noted or called for on the Plans.
- B. Curing Compounds:
 - 1. Regular Portland Cement Concrete: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.8 FORM REMOVAL

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

3.9 FIELD QUALITY CONTROL

- A. Finish subgrade for concrete improvements shall be subject to approval prior to placement of forms.
- B. No concrete shall be placed prior to approval of forms.
- C. Concrete improvements constructed shall not contain "bird baths" or pond water and shall be smooth and ridge free.
- D. Conform the finish grade and cross section of concrete improvements to the design grades and cross sections.
- E. Variation of concrete improvements from design grade and cross section as shown or called for on the plans shall not exceed the tolerances ACI 117 and as follows:
 - 1. Elevation: $\frac{1}{4}$ inch.
 - 2. Thickness: Plus $\frac{3}{8}$ inch, minus $\frac{1}{4}$ inch.
 - 3. Surface: Gap below 10 foot long, unleveled straightedge not to exceed $\frac{1}{4}$ inch.
 - 4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
 - 5. Vertical Alignment of Tie Bars and Dowels: $\frac{1}{4}$ inch.
 - 6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: $\frac{1}{2}$ inch.
 - 7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel $\frac{1}{4}$ inch per 12 inches.
 - 8. Joint Spacing: 3 inches, unless otherwise indicated.
 - 9. Contraction Joint Depth: Plus $\frac{1}{4}$ inch, no minus.
 - 10. Joint Width: Plus $\frac{1}{8}$ inch, no minus.

3.10 RESTORATION OF EXISTING IMPROVEMENTS

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

END OF SECTION

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SECTION 33 05 16

UTILITY STRUCTURES

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Manhole structures for gravity storm drain and sanitary sewer utilities.

1.2 RELATED SECTIONS

- A. Section 31 23 33 – Trenching and Backfilling.
- B. Section 33 40 00 – Storm Drainage Utilities.
- C. Section 32 13 13 – Concrete Paving.

1.3 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. “Geotechnical Investigation Venetia Valley K-8 School”, prepared by Miller Pacific Engineering Group, dated April 27, 2017.
- C. AASHTO:
 - 1. M 199: Precast Reinforced Concrete Manhole Sections.
- D. ASTM:
 - 1. A 615/A615M: Deformed and Billet-Steel Bars for Concrete Reinforcement.
 - 2. C 478: Precast Reinforced Concrete Manhole Sections.
 - 3. C 1244: Test Method for Concrete Sewer Manholes by Negative Air Pressure (Vacuum) Test.
- E. Caltrans Caltrans Standard Specifications.
 - 1. Section 51, Concrete Structures.
 - 2. Section 75, Miscellaneous Metal.

1.4 DEFINITIONS

- A. AASHTO: American Association of State Highway and Transportation Officials.
- B. ASTM: American Society for Testing Materials.

1.5 SUBMITTALS

- A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.
- B. Product data for the following:
 - 1. Cleanout plugs or caps.
- C. Shop drawings: Include plans, elevations, details and attachments for the following:
 - 1. Precast concrete manholes, frames and covers.
 - 2. Precast concrete clean out boxes and box covers.
- D. Design Mix Reports and Calculations: For each class of cast-in-place concrete.
- E. Field Test Reports: Indicate and interpret test results for compliance with performance.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Handle precast concrete manholes according to manufacturer's written instructions.
- B. Protect imported bedding and backfill material from contamination by other materials.

PART 2 PRODUCTS

2.1 CLEANOUTS

- A. Piping: Same as sanitary sewer line if possible.
- B. Top Cap: Threaded and of same material as piping if possible.
- C. Box Size: As required to provide access and allow easy removal and reinstallation of cap.
- D. Box Types:
 - 1. Non-Traffic Areas: Portland cement concrete box and box cover, light duty.
 - 2. Traffic Areas: Portland cement concrete box and box cover or steel or cast iron cover, heavy duty, both box and cover to be rated for AASHTO H20 loading.
- E. Box Cover Markings: "S.D." for storm drain cleanouts, "S.S." for sanitary sewer cleanouts, unless otherwise specified.
- F. Available Manufacturers: Subject to compliance with requirements, box manufacturers offering products that may be incorporated into the Project include, but are not limited to the following:
 - 1. Associated Concrete Products, Inc. (Santa Ana, California) (Tel. 714-557-7470).
 - 2. Brooks Products Inc. (El Monte, California) (Tel. 818-443-3017).
 - 3. Christy Concrete Products, Inc. (Fremont, California) (Tel. 800-486 7070).

2.2 MANHOLES

- A. General: Size, shape, configuration, depth, etc. of manhole and frame and cover shall be as indicated.
- B. Portland Cement Concrete and Reinforcing:
 - 1. Cast-In-Place Portion: Use Class A Concrete per Caltrans Standard Specification Section 90, and ASTM A615 Grade 60 reinforcing steel bars.
 - 2. Precast Portion: ASTM C 478. Rate for AASHTO H20 loading in traffic areas.
- C. Frames and Covers: As indicated and in accordance with Caltrans Standard Specification Section 75-1.02.
- D. Steps: ASTM C 478 or AASHTO M 199. Manufacture from deformed, ½-inch steel reinforcement rod complying with ASTM A 615 and encased in polypropylene complying with ASTM D4101. Include pattern designed to prevent lateral slippage off step. Acceptable manufacturer is Hanson Concrete Products, (Milpitas, CA) (Tel 408-262-1091) or equal.
- E. Force Main Piping Access Openings:
 - 1. General: As indicated.

2.3 JOINT SEALANT FOR STRUCTURES AND MANHOLES

- A. Mortar: Caltrans Standard Specification Section 51-1.135.
 - 1. Use to seal around pipes at connections to structures and manholes. Also use to seal joints between precast sections of structures and manholes.
- B. Gaskets: Preformed flexible rubber or plastic gasket.
 - 1. Rubber Gaskets: ASTM C443.
 - 2. Plastic Gaskets: Federal Specification SS-S-00210 (GSA-FSS), Type I, Rope Form; or alternate standard which may exist. Acceptable material is "Ram-Nek," as manufactured by the K. T. Snyder Company (Houston TX), or equal.

PART 3 EXECUTION

3.1 CLEANOUT INSTALLATION

- A. General: Install as indicated.

3.2 MANHOLE INSTALLATION

- A. General: Install as indicated.

3.3 TESTING OF MANHOLES ON GRAVITY LINES

- A. At the option of the Contractor, either the following hydrostatic or vacuum test shall be performed.

B. Hydrostatic Test:

1. Insert inflatable plugs in all sewer inlets and outlets.
2. Fill the manhole with water to a point six inches below the base of the manhole frame.
3. Maintain the water at this point for one hour to allow time for absorption.
4. Begin one-hour test period. Measure the amount of water added in one-hour period to maintain the water level at six inches below the base of the manhole frame. Do not allow water level to drop more than 25% of the manhole depth.
5. Determine the allowable leakage by the following formula.
6. $L = 0.0002 \times D \times H^{1/2}$
7. L = Allowable leakage, gallons per minute.
8. D = Depth of manhole from top to bottom, feet.
9. H = Head of water in feet as measured from the surface of the water in the manhole to the sewer line invert or to the prevailing ground water surface outside the manhole. The lesser height governs.
10. If the leakage exceeds the allowable, determine the cause, take remedial action and re-test the manhole. If the leakage is less than the allowable and leaks are observed, repair the leaks.

C. Vacuum Test:

1. General: Test in accordance with ASTM C 1244.
2. Test prior to backfilling around the manhole.
3. Test Preparation: Plug all lift holes and pipes entering or exiting the manhole.
4. Place test head inside the top section of the manhole's cone section and inflate in accordance with the manufacturers instructions.
5. Draw a vacuum of 10-inches of mercury and shut the pump off.
6. With the valve closed, the time for the vacuum to drop 9-inches shall be measured.
7. The manhole shall pass the test if the time is greater than 60 seconds for a 48-inch diameter manhole, 75 seconds for a 60-inch diameter manhole and 90 seconds for a 72-inch diameter manhole.
8. If the manhole fails the initial test, make necessary repairs with a non-shrink grout while the vacuum is still being drawn. Retest until a satisfactory test is obtained.

END OF SECTION

SECTION 33 40 00

STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Roadway and/or site storm drainage up to 5-feet of any on-site building.

1.02 RELATED SECTIONS

- A. Section 31 23 33 – Trenching and Backfilling.
- B. Section 32 13 13 – Concrete Paving.

1.03 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. "Geotechnical Investigation Venetia Valley K-8 School", prepared by Miller Pacific Engineering Group, dated April 27, 2017.
- C. AASHTO:
 - 1. M 252: Corrugated Polyethylene Drainage Tubing.
 - 2. M 294: Corrugated Polyethylene Pipe, 12 to 24-inch Diameter.
- D. ASTM:
 - 1. A 74: Cast Iron Soil Pipe and Fittings.
 - 2. A 615/A615M: Deformed and Billet-Steel Bars for Concrete Reinforcement.
 - 3. C 443: Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
 - 4. C 564: Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
 - 5. C 1173: Flexible Transition Couplings for Underground Piping Systems.
 - 6. D 1785: Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
 - 7. D 2235: Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and fittings.
 - 8. D 2321: Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications.
 - 9. D 2564: Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
 - 10. D 2751: Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
 - 11. D 3034: Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - 12. D 4101: Specifications for Propylene Injection and Extrusion Materials.
 - 13. F 477: Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
 - 14. F 656: Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

15. F 679: Specification for Poly(Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings.
16. F-1336: Poly(Vinyl Chloride) (PVC) Gasket Sewer Fittings.
- E. AWWA:
 1. C104: Cement Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
 2. C105: Polyethylene Encasement for Ductile-Iron Pipe Systems.
 3. C110: Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76 mm Through 1,219 mm) for Water.
 4. C111: Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 5. C150: Thickness design of Ductile Iron Pipe.
 6. C151: Ductile-Iron Pipe, Centrifugally Cast, for Water.
 7. C153: Ductile-Iron Compact Fittings for Water Service.
 8. M41: Ductile Iron Pipe and Fittings.
- F. Caltrans Standard Specifications:
 1. Section 65, Reinforced Concrete Pipe.
 2. Section 66, Corrugated Metal Pipe.
 3. Section 70. Miscellaneous Facilities.
 4. Section 72, Slope Protection.
- G. Caltrans Standard Plans:
 1. Plan D94A: Metal and Plastic Flared End Sections.
 2. Plan D94B: Concrete Flared End Sections.
 3. Plan D97A: Corrugated Metal Pipe Coupling Details No.1, Annular Coupling Band Bar and Strap and Angle Connection.
 4. Plan D97B: Corrugated Metal Pipe Coupling Details No. 2, Hat Band Coupler and Flange Details.
 5. Plan D97C: Corrugated Metal Pipe Coupling Details No. 3, Helical and Universal Couplers.
 6. Plan D97D: Corrugated Metal Pipe Coupling Details No. 4, Hugger Coupling Bands.
 7. Plan D97E: Corrugated Metal Pipe Coupling Details No. 5, Standard Joint.
 8. Plan D97F: Corrugated Metal Pipe Coupling Details No. 6, Positive Joint.
 9. Plan D97G: Corrugated Metal Pipe Coupling Details No. 7, Positive Joints and Downdrains.
 10. Plan D98A: Slotted Corrugated Steel Pipe Drain Details.
 11. Plan D98B: Slotted Corrugated Steel Pipe Drain Details.

1.04 DEFINITIONS

- A. AASHTO: American Association of State Highway and Transportation Officials.
- B. ABS: Acrylonitrile-butadiene-styrene.
- C. ASTM: American Society for Testing Materials.
- D. AWWA: American Water Works Association.
- E. CMP: Corrugated metal pipe.

- F. DIP: Ductile iron pipe.
- G. HDPE: High-density polyethylene.
- H. NPS: Nominal pipe size.
- I. PE: Polyethylene.
- J. PVC: Polyvinyl chloride.
- K. RCP: Reinforced concrete pipe.

1.05 SUBMITTALS

- A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.
- B. Product Data Shop Drawings, Etc.: For the following:
 - 1. Piping materials and fittings.
 - 2. Special pipe couplings.
 - 3. Polymer-concrete, channel drainage systems (trench drains).
 - 4. Joint sealants.
 - 5. Plastic area drains.
 - 6. Precast concrete catch basins, inlets, curb inlets, and area drains, including frames and grates.
 - 7. Concrete, metal and plastic flared end sections.
- C. Design Mix Reports and Calculations: For each class of cast in place concrete.
- D. Field Test Reports: Indicate and interpret test results for compliance with performance.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Do not store plastic structures, pipe and fittings in direct sunlight.
- B. Protect pipe, fittings, and seals from dirt and damage.
- C. Handle precast concrete pipe and other precast structures according to manufacturer's written instructions.
- D. Protect imported bedding and backfill material from contamination by other materials.

PART 2 PRODUCTS

2.01 PIPING MATERIALS

- A. ABS Pipe and Fittings: Smaller than 4-inch, ASTM D 2751, SDR 35. Solvent cement joints.

1. Solvent Cement: ASTM D 2235.
- B. ABS Pipe and Fittings: 4-inch through 12 inch, ASTM D 2751, SDR 35. Bell and spigot joints.
 1. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F 477.
- C. Cast Iron Pipe and Fittings: Hub and spigot, 2-inch through 15-inch, ASTM A74, service class.
 1. Gaskets: ASTM 564, rubber, compression type, thickness to match class of pipe.
- D. Corrugated Metal Pipe and Fittings: Caltrans Standard Specification Section 66.
 1. Bituminous Coating: Caltrans Standard Specification Section 66-1.03.
 2. Bituminous Lining: Caltrans Standard Specification Section 66-1.03.
 3. Bituminous Pavings: Caltrans Standard Specification Section 66-1.03.
 4. Corrugated Aluminum Pipe: Caltrans Standard Specification Section 66-2.
 5. Corrugated Steel Pipe: Caltrans Standard Specification Section 66-3.
 6. Slotted Corrugated Steel Pipe: Caltrans Standard Specification Section 66-3.09.
 7. Details: Caltrans Standard Plans D97A, D97B, D97C, D97D, D97E, D97F, D97G, D98A and D98B.
- E. DIP: Sizes 4-inch through 48-inch.
 1. Pipe: AWWA C150 and C151.
 2. Pressure Class: Minimum pressure class for size indicated.
 3. Fittings:
 - a. Standard: AWWA C110, sizes 4-inch through 48-inch.
 - b. Compact: AWWA C153, sizes 4-inch through 24-inch.
 4. Pipe and Fitting Lining: Cement Mortar, AWWA C104.
 5. Pipe and Fitting Coating: Asphaltic, AWWA C151 or C115.
 6. Exterior Soil Corrosion Protection for Pipe and Fittings: Polyethylene encasement, AWWA C105.
 7. Joints:
 - a. Push-On Bell and Spigot Joint: AWWA C111.
 - b. Mechanical Joint: AWWA C111.
 - c. Flanged joint. AWWA C115.
- F. Reinforced Concrete Pipe: Designated by Class, rubber gasketed joints.
 1. Circular Reinforced Concrete Pipe: Caltrans Standard Specification Section 65-1.02A(1). Class III.
 2. Oval shaped (Elliptical) Reinforced Concrete Pipe: Caltrans Standard Specification Section 65-1.02B. Class HE-III and VE-III.
 3. Reinforced Concrete Pipe Arch: Caltrans Standard Specification Section 65-1.02C.
 4. Rubber Gasketed Joints: Caltrans Standard Specification Section 65-1.06.
- G. PE Pipe and Fittings: 4-inch through 10-inch, AASHTO M 252 Type S, smooth interior and corrugated exterior. Bell and spigot joints.
 1. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F 477.
 2. Couplings: AASHTO M 252, corrugated band type. Engage a minimum of 4 corrugations, 2 on each side of pipe joint.

3. .
- H. PE Pipe and Fittings: 12-inch through 48-inch, AASHTO M 294. Type S, smooth interior and corrugated exterior. Bell and spigot joints.
 1. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F 477.
 2. Couplings: AASHTO M 252, corrugated band type. Engage a minimum of 4 corrugations, 2 on each side of pipe joint.
- I. PVC Pipe and Fittings-Smaller than 4-Inch: ASTM D1785, Schedule 40.
 1. Joints: Solvent Cement, ASTM D 2564. Include primer according to ASTM F656.
- J. PVC Pipe and Fittings, 4-Inch and Larger
 1. Pipe:
 - a. 4-inch through 15-inch: ASTM D 3034, SDR 35. Bell and spigot joints.
 - b. 18 inch through 36-inch: ASTM F 679, T-1 wall. Bell and spigot joints.
 2. Fittings:
 - a. 4-inch through 27-inch: ASTM F 1336.
 - b. 30-inch through 36-inch: ASTM D 3034, SDR 35
 3. Joint Gasket: Elastomeric seal, ASTM F 477.

2.02 PIPE ANCHORS

- A. Section 32 05 23 – Cement and Concrete for Exterior Improvements

2.03 SPECIAL PIPE COUPLINGS

- A. Plastic, Cast Iron and Ductile Iron Pipe: ASTM C 1173, rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined.
- B. Reinforced Concrete Pipe: Portland cement concrete collar as indicated.
- C. Section 32 05 23 – Cement and Concrete for Exterior Improvements

2.04 CURB INLETS, CATCH BASINS, DROP INLETS, AREA DRAINS, ETC.

- A. General: Size, shape, configuration, depth, etc. of structure and frame, grate, or cover shall be as indicated.
- B. Section 32 05 23 – Cement and Concrete for Exterior Improvements
- C. Precast Structure: Rate for AASHTO H20 loading in traffic areas.
- D. Steps: ASTM C 478 or AASHTO M 199. Manufacture from deformed, ½-inch steel reinforcement rod complying with ASTM A 615 and encased in polypropylene complying with ASTM D4101. Include pattern designed to prevent lateral slippage off step. Acceptable manufacturer is Hanson Concrete Products, (Milpitas, CA) (Tel 408-262-1091).
- E. Frames, Grates and Covers: Caltrans Standard Specification Section 75-1.02, 75-1.03 and 75-1.05.

1. Galvanize steel frames, grates and covers.
2. Grates and covers shall be non-rocking.
3. Rate for AASHTO H20 loading in traffic areas.

2.05 MANHOLES AND CLEANOUTS

- A. See Section 33 05 16 – Utility Structures.

2.06 POLYMER-CONCRETE TRENCH DRAINS

- A. General: Modular system of precast, polymer-concrete channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling. Include number of units required to form total length required.
- B. Include the following components:
 1. Channel Sections: Interlocking-joint, precast modular units with end caps. Inside width as indicated with deep, rounded bottom, with built in slope or flat invert as indicated and outlets in number, sizes, and locations indicated. Include extension sections necessary for required depth.
 2. Frame and Grate: Gray iron, ductile iron or galvanized steel as indicated. Where drain is located in traffic areas, rate for AASHTO H20 loading.
- C. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.
- D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
 1. "Polydrain" by ABT Inc. (Troutman, NC) (Tel 704-528-9806).
 2. "ACO Drain" by ACO Polymer Products Inc. (Chardon, OH) (Tel. 800-543-4764).

2.07 METAL, CONCRETE OR PLASTIC FLARED END SECTIONS

- A. General: Caltrans Standard Specification Section 70-1.02C and Caltrans Standard Plan D94A and D94B.

2.08 SLOPE PROTECTION

- A. Rock Slope Protection: Caltrans Standard Specification Section 72-2.02.
 1. Class: *[Select Class applicable to the Project.]*
 2. Fabric: Caltrans Standard Specification Section 72-2.025.
- B. Concrete/Shotcrete Slope Protection: Caltrans Standard Specification Section 72-4.03.
 1. Bar Reinforcement: Caltrans Standard Specification Section 52-1.02A, minimum Grade 40.
 2. Welded Wire Fabric: Caltrans Standard Specification Section 52-1.02C. Use 6 x 6-W1.4 xW1.4 unless otherwise indicated.

- C. Concreted-Rock Slope Protection: Caltrans Standard Specification Section 72-5.02.
 - 1. Class: *[Select Class applicable to the Project.]*
- D. Sacked Concrete Slope Protection.
 - 1. Concrete: Caltrans Standard Specification Section 90, Class 3.
 - 2. Sacks: 10 ounce burlap measuring approximately 19.5-inches by 36 inches when empty and laid flat.

2.09 CONCRETE/SHOTCRETE DITCH LINING

- A. General: Caltrans Standard Specification Section 72-4.03.
 - 1. Bar Reinforcement: Caltrans Standard Specification Section 52-1.02A, minimum Grade 40.
 - 2. Welded Wire Fabric: Caltrans Standard Specification Section 52-1.02C. Use 6 x 6-W1.4 xW1.4 unless otherwise indicated.

PART 3 EXECUTION

3.01 PIPE INSTALLATION

- A. General: Install pipe, fittings, and appurtenances utilizing best practices, manufacturer's instructions, and in accordance with Section 6 and 7 of ASTM D 2321 for plastic pipe, Caltrans Standard Specification Section 65-1.07 for reinforced concrete pipe, Caltrans Standard Specification Sections 66-1.045 and 66-105 for corrugated metal pipe and chapter 11.3.3 of AWWA M41 for cast iron and ductile iron pipe.
- B. Pipe Depth and Trench Configuration: Conform to typical trench section(s) indicated.
- C. Excavation, Bedding, Backfill, and Compaction: Section 31 23 33 – Trenching and Backfilling.
- D. Handling: Carefully handle during loading, hauling, unloading and placing operations to avoid breakage or damage. Use strap type slings for lifting and placing; no chains or hooks will be permitted. Comply with manufacturer's recommendations.
- E. Laying: Before lowering pipe into the trench, remove all stakes, debris, loose rock and other hard materials from the bottom of the trench. Lay accurately in conformance with lines and grades indicated. Start laying the pipeline at the low end and proceed upstream. Lay bell and spigot pipe with the bell end facing upstream. Lay pipe on a bed prepared by handwork, dug true to grade. Furnish firm bearing for pipe throughout it's entire length with bell holes provided at the ends of each pipe length of sufficient size to permit making up the particular type of joint being used. Adjust pipe to line and grade by scraping away or filling and tamping material under the body of the pipe for the entire pipe length and not by blocking or wedging. After final positioning, hold pipe in place in trench

with backfill material placed equally on both sides of the pipe at as many locations as required to hold the pipe section in place.

- F. Curved Alignment: When necessary to conform to the alignment specifically indicated, lay pipe on a curved alignment by means of asymmetrical closure of joints or bending of the pipe barrel. Use shorter lengths of pipe than the standard length if necessary to achieve curvature specified. Do not exceed the recommendations of the pipe manufacture for deflections at the joints or pipe bending.
- G. Closure: Close open ends of pipes and appurtenance openings at the end of each days work or when work is not in progress.

3.02 INSTALLATION OF PIPE ANCHORS

- A. Install at location, configuration and details shown on the Plans.

3.03 SPECIAL PIPE COUPLINGS

- A. General: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.
- B. Installation: Per manufacturer's instructions.

3.04 INSTALLATION OF CURB INLETS, CATCH BASINS, DROP INLETS, AREA DRAINS, ETC.

- A. Excavation, Bedding, Backfill, and Compaction: Section 31 23 33 – Trenching and Backfilling.
- B. Poured in Place Structures: Install as indicated and Caltrans Standard Specification Section 51.
 - 1. Shape bottoms to convey flows as indicated.
- C. Precast Structures: Install as indicated.
 - 1. Seal all joints and pipe entrances and exits.
 - 2. Place concrete in bottom and shape to convey flows as indicated.

3.05 POLYMER-CONCRETE TRENCH DRAIN INSTALLATION

- A. Excavation, Bedding, Backfill, and Compaction: Section 31 23 33 – Trenching and Backfilling.
- B. Install: As indicated and in accordance with the manufacturer's instructions.

3.06 CONCRETE OR PLASTIC FLARED END SECTION INSTALLATION

- A. Install: As indicated.

3.07 SLOPE PROTECTION PLACEMENT

- A. Rock Slope Protection: Caltrans Standard Specification Section 72-2.03 and as indicated.
 - 1. Use Method B Placement unless otherwise indicated.
- B. Concrete/Shotcrete Slope Protection: Caltrans Standard Specification Section 72-4.02 and 72-4.04.
- C. Concreted-Rock Slope Protection: Caltrans Standard Specification Section 72-5.03 and 72-5.04.
 - 1. Use Method B Placement unless otherwise indicated.
- D. Sacked Concrete Slope Protection.
 - 1. Detailed configuration: As indicated.
 - 2. Use one cubic foot of concrete per sack.
 - 3. Locate headers and stretchers as indicated.
 - 4. Headers: Folded end to bank.
 - 5. Stretchers: Folded ends are not to be adjacent.
 - 6. Place no more than four vertical courses until initial set has taken place in first course.

3.08 CONCRETE/SHOTCRETE DITCH LINING PLACEMENT

- A. Concrete/Shotcrete Slope Protection: Caltrans Standard Specification Section 72-4.02 and 72-4.04.

3.09 TESTING

- A. General: Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 - 1. Do not enclose, cover, or put into service before inspection and approval.
 - 2. Test completed piping systems according to authorities having jurisdiction.
 - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours advance notice.
 - 4. Submit separate reports for each test.
 - 5. Where authorities having jurisdiction do not have published procedures, perform tests in accordance with latest edition of the Uniform Plumbing Code (UPC) Section 1109.0, Testing.
 - 6. Leaks and loss in test pressure constitute defects that must be repaired.
 - 7. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION

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