

GROSSMONT UNION HIGH SCHOOL DISTRICT

MAINTENANCE AND OPERATIONS FACILITY MULTI-PRIME

ATTACHMENT C TECHNICAL SPECIFICATIONS

GROSSMONT UNION HIGH SCHOOL DISTRICT

This substitution request form may be used for Pre-Bid Substitution Requests or Post-Bid Substitution Requests.

TO: _____

PROJECT: _____

SPECIFICATION ITEM:

Section	Page	Paragraph	Description
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Substitution approval is an acceptance of only the manufacturer and product for general conformance with the design concept reflected in the Contract Documents. The A/E has made no attempt to verify specific performance data, or to check the details of the proposed substitution as to special features, capacities, physical dimensions or code and/or regulatory compliance, all of which remain the responsibility of the person/entity submitting the proposed substitution.

The undersigned requests consideration of the following:

PROPOSED SUBSTITUTION:

Attached data includes product 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. The proposed substitution does not affect dimensions shown on the Drawings.
2. The undersigned will pay for changes to the building design, including engineering design, detailing, and construction costs caused by the requested substitution.
3. costs caused by the requested substitution.
4. The proposed substitution will have no adverse effect on other trades, the construction schedule, or specified warranty requirements.
5. requirements.
6. Maintenance and service parts will be locally available for the proposed substitution.

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

The undersigned agrees that, if this page is reproduced, the terms and conditions for substitutions found in the Bidding Documents apply to this request.

SUBMITTED ON _____, _____ BY:

Name

Signature

Company Name

Address

City State Zip Code

For Use by Design Consultant:

- ☐ Accepted
☐ Accepted as Noted
☐ Not Accepted
☐ Submitted Late

By: _____

Date: _____

SPECIFICATIONS FOR

**MAINTENANCE & OPERATIONS FACILITY
GROSSMONT HIGH SCHOOL
GROSSMONT UNION HIGH SCHOOL DISTRICT**

1.30.12

DSA SUBMITTAL A# 04-116672
SEPTEMBER 11, 2017



Contract Documents for New Buildings 100, 200, 300 Carport and Print Shop

Grossmont Union School District
Grossmont, California
ARCHITECTS AND ENGINEERS SIGNATURE PAGE

Architect
David Ruhnuu, AIA #C-20662
Ruhnuu Clarke Architects



Structural Engineer
Robert Randall
Saiful Bouquet



Mechanical Engineer
Cesar Rodriguez
Turpin and Rattan



Electrical Engineer
Dale Franchak
Turpin and Rattan



IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT

04 # 116672

ACS DIA FLS th SS RT
DATE 01/18/2018
ACS: DANIEL HONG

FLS: f. burke
SSS: Ryan Turner

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END OF DOCUMENT 000010

DOCUMENT 003132

GEOTECHNICAL DATA

1.1 GEOTECHNICAL DATA

- A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents.
- B. A geotechnical investigation report for Project, prepared for Grossmont Union High School District, prepared by MTGL, Inc., titled GEOTECHNICAL INVESTIGATION, Maintenance & Operations Facility Relocation, Grossmont Union High School District, 1100 Murray Drive, El Cajon, California, dated April 28, 2017, is available for viewing at the office of Construction Manager.

END OF DOCUMENT 003132

SECTION 01 10 00

SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Access to site.
4. Work restrictions.
5. Specification and drawing conventions.

B. Related Requirements:

1. Section 01 50 00 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.2 PROJECT INFORMATION

A. Project Identification: GUHSD Maintenance & Operations Facility.

1. Project Location: 1100 Murray Drive, El Cajon, CA 92020.

B. Owner: Grossmont Union High School District.

C. Architect: Ruhnau Ruhnau Clarke.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1. As indicated on Drawings.

B. Type of Contract.

1. Project will be constructed under a single prime contract.

1.4 ACCESS TO SITE

A. General: Construction manager shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

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

1.5 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work in the existing building to working hours as determined by the Owner, Monday through Sunday, unless otherwise indicated.
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted by Owner in writing.
 - 1. Coordinate the work and sequence of installation of the various utilities and facilities. Coordinate connection of utility systems with public agencies and other trades. Comply with requirements of governing agencies and regulations. Notify Architect of any conflict.
- D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1.6 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - 2. Specification requirements are to be performed by Construction manager unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 - 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 - 2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
 - 1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.2 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Construction Manager.

1.3 ACTION SUBMITTALS

- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use form acceptable to Owner.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
 - b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
 - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.

- i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
 - j. Detailed comparison of Construction Manager's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. Construction Manager's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
 - m. Construction Manager's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Construction Manager of acceptance or rejection of proposed substitution within seven days of receipt of request.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.4 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

- A. Substitutions for Cause: Architect will consider requests for substitution if received in accordance with Public Contract Code Section 3400, a minimum 10 days prior to submission of bid.
- 1. Conditions: Architect will consider Construction Manager's request for substitution when the following conditions are satisfied:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Requested substitution will not adversely affect Construction Manager's construction schedule.
 - c. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - d. Requested substitution is compatible with other portions of the Work.
 - e. Requested substitution has been coordinated with other portions of the Work.

- f. Requested substitution provides specified warranty.
 - g. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Architect will consider requests for substitution if received in accordance with Public Contract Code Section 3400, a minimum 10 days prior to submission of bid.
 - 1. Conditions: Architect will consider Construction Manager's request for substitution when the following conditions are satisfied:
 - a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - b. Requested substitution does not require extensive revisions to the Contract Documents.
 - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - d. Requested substitution will not adversely affect Construction Manager's construction schedule.
 - e. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - f. Requested substitution is compatible with other portions of the Work.
 - g. Requested substitution has been coordinated with other portions of the Work.
 - h. Requested substitution provides specified warranty.
 - i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 01 26 00

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1.2 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on form acceptable to Owner.

1.3 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Construction Manager's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - e. Quotation Form: Use forms acceptable to Owner.
- B. Construction Manager-Initiated Work Change Proposals: If latent or changed conditions require modifications to the Contract, Construction Manager may initiate a claim by submitting a request for a change to Architect.
 - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 - 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.

3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Construction Manager's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Work Change Proposal Request Form: Use form acceptable to Owner.

1.4 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Changes Proposal Request, Architect will issue a Change Order for signatures of Owner and Construction Manager on form acceptable to Owner.

1.5 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on form acceptable to Owner. Construction Change Directive instructs Construction Manager to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 01 29 00

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
 - 1. Section 01 20 00 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.

1.2 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Construction Manager's construction schedule.
 - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with continuation sheets.
 - b. Submittal schedule.
 - c. Items required to be indicated as separate activities in Construction Manager's construction schedule.
 - 2. Submit the schedule of values to Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
 - 1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.
 - b. Name of Architect.
 - c. Architect's project number.
 - d. Construction Manager's name and address.
 - e. Date of submittal.
 - 2. Arrange schedule of values consistent with format of AIA Document G703.
 - 3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
 - 4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
6. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Construction Manager's option.
7. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.3 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Construction Manager. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
- C. Application for Payment Forms: Use forms acceptable to Owner and Architect for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Construction Manager. Architect will return incomplete applications without action.
 1. Entries shall match data on the schedule of values and Construction Manager's construction schedule. Use updated schedules if revisions were made.
 2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the 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 conditional final or full waivers.

3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Waiver Forms: Submit executed waivers of lien on forms 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. Construction Manager's construction schedule (preliminary if not final).
 4. Schedule of unit prices.
 5. Submittal schedule (preliminary if not final).
 6. List of Construction Manager's staff assignments.
 7. List of Construction Manager's principal consultants.
 8. Copies of building permits.
 9. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 10. Initial progress report.
 11. Report of preconstruction conference.
 12. Certificates of insurance and insurance policies.
- H. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- I. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA Document G706-1994, "Contractor's Affidavit of Payment of Debts and Claims."
 5. AIA Document G706A-1994, "Contractor's Affidavit of Release of Liens."
 6. AIA Document G707-1994, "Consent of Surety to Final Payment."
 7. Evidence that claims have been settled.
 8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. Requests for Information (RFIs).
 - 2. Project meetings.
- B. Related Requirements:
 - 1. Section 01 73 00 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.2 DEFINITIONS

- A. RFI: Request from Owner, Architect, or Construction Manager seeking information required by or clarifications of the Contract Documents.

1.3 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.

1.4 GENERAL COORDINATION PROCEDURES

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

- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

- 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

1.5 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Construction Manager shall prepare and submit an RFI in the form specified.

- 1. Architect will return RFIs submitted to Architect by other entities controlled by Construction Manager with no response.
 - 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Construction Manager's work or work of subcontractors.

- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

- 1. Project name.
 - 2. Project number.
 - 3. Date.
 - 4. Name of Construction Manager.
 - 5. Name of Architect.
 - 6. RFI number, numbered sequentially.
 - 7. RFI subject.
 - 8. Specification Section number and title and related paragraphs, as appropriate.
 - 9. Drawing number and detail references, as appropriate.
 - 10. Field dimensions and conditions, as appropriate.
 - 11. Construction Manager's suggested resolution. If Construction Manager's solution(s) impacts the Contract Time or the Contract Sum, Construction Manager shall state impact in the RFI.
 - 12. Construction Manager's signature.
 - 13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

- C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect.

- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

- 1. The following RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for coordination information already indicated in the Contract Documents.
 - d. Requests for adjustments in the Contract Time or the Contract Sum.
 - e. Requests for interpretation of Architect's actions on submittals.

- f. Incomplete RFIs or inaccurately prepared RFIs.
 - 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
 - 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Construction Manager to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
 - a. If Construction Manager believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 7 days of receipt of the RFI response.
 - E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Software log with not less than the following:
 - 1. Project name.
 - 2. Name and address of Construction Manager.
 - 3. Name and address of Architect.
 - 4. RFI number including RFIs that were dropped and not submitted.
 - 5. RFI description.
 - 6. Date the RFI was submitted.
 - 7. Date Architect's response was received.
 - F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Construction Manager disagrees with response.
 - 1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
- 1.6 PROJECT MEETINGS
- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
 - 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 - 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 - 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, and Architect, within three days of the meeting.
 - B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
 - 1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Construction Manager and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.

- b. Phasing.
 - c. Critical work sequencing and long-lead items.
 - d. Designation of key personnel and their duties.
 - e. Procedures for processing field decisions and Change Orders.
 - f. Procedures for RFIs.
 - g. Procedures for testing and inspecting.
 - h. Procedures for processing Applications for Payment.
 - i. Distribution of the Contract Documents.
 - j. Submittal procedures.
 - k. Preparation of record documents.
 - l. Use of the premises.
 - m. Work restrictions.
 - n. Working hours.
 - o. Owner's occupancy requirements.
 - p. Responsibility for temporary facilities and controls.
 - q. Procedures for moisture and mold control.
 - r. Procedures for disruptions and shutdowns.
 - s. Construction waste management and recycling.
 - t. Parking availability.
 - u. Office, work, and storage areas.
 - v. Equipment deliveries and priorities.
 - w. First aid.
 - x. Security.
 - y. Progress cleaning.
3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
- 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
 - 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Possible conflicts.
 - i. Compatibility problems.
 - j. Time schedules.
 - k. Weather limitations.
 - l. Manufacturer's written instructions.
 - m. Warranty requirements.
 - n. Compatibility of materials.
 - o. Acceptability of substrates.
 - p. Temporary facilities and controls.
 - q. Space and access limitations.
 - r. Regulations of authorities having jurisdiction.

- s. Testing and inspecting requirements.
 - t. Installation procedures.
 - u. Coordination with other work.
 - v. Required performance results.
 - w. Protection of adjacent work.
 - x. Protection of construction and personnel.
3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Progress Meetings: Conduct progress meetings at regular intervals.
1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Construction Manager's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Construction Manager's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Progress cleaning.
 - 10) Quality and work standards.
 - 11) Status of correction of deficient items.
 - 12) Field observations.
 - 13) Status of RFIs.
 - 14) Status of proposal requests.
 - 15) Pending changes.
 - 16) Status of Change Orders.
 - 17) Pending claims and disputes.
 - 18) Documentation of information for payment requests.

3. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
 - a. Schedule Updating: Revise Construction Manager's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action.

1.3 ACTION SUBMITTALS

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic copies of digital data files of the Contract Drawings will not be provided by Architect for Construction Manager's use in preparing submittals.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - 1. Initial Review: Allow 7 days for initial review of each submittal.
- D. Paper Submittals: Place a permanent label or title block on each submittal item for identification.
 - 1. Indicate name of firm or entity that prepared each submittal on label or title block.
 - 2. Provide a space approximately 6 by 8 inches on label or beside title block to record Construction Manager's review and approval markings and action taken by Architect.
 - 3. Include the following information for processing and recording action taken:

- a. Project name.
- b. Date.
- c. Name of Architect.
- d. Name of Construction Manager.
- e. Name of Construction Manager.
- f. Name of subcontractor.
- g. Name of supplier.
- h. Name of manufacturer.
- i. Submittal number or other unique identifier, including revision identifier.

- 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).

- j. Number and title of appropriate Specification Section.
- k. Drawing number and detail references, as appropriate.
- l. Location(s) where product is to be installed, as appropriate.
- m. Other necessary identification.

E. Options: Identify options requiring selection by Architect.

F. Deviations: Identify deviations from the Contract Documents on submittals.

G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

- 1. Note date and content of previous submittal.
- 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
- 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

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

I. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements:

- 1. Action Submittals: Submit three paper copies of each submittal unless otherwise indicated. Architect, will return two copies.
- 2. Informational Submittals: Submit two paper copies of each submittal unless otherwise indicated. Architect will not return copies.
- 3. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 5. Submit Product Data before or concurrent with Samples.
 6. Submit Product Data in the following format:
 - a. Three paper copies of Product Data unless otherwise indicated. Architect will return two copies.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
 3. Submit Shop Drawings in the following format:
 - a. Two opaque (bond) copies of each submittal. Architect will return one copy.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of applicable Specification Section.
3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Construction Manager.
5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Submit product schedule in the following format:
 - a. PDF electronic file.
- F. Coordination Drawings Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."
- G. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."

- H. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."
- I. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."
- J. Maintenance Data: Comply with requirements specified in Section 017800 "Project Record Documents."
- K. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- L. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- M. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- N. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- O. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- P. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- Q. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- R. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- S. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.
- T. Schedule of Tests and Inspections: Comply with requirements specified in Section 01400 "Quality Requirements."
- U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

- W. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Action Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Section 01770 "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Construction Manager's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

- A. General: Architect will not review submittals that do not bear Construction Manager's approval stamp and will return them without action.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- C. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- D. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 013300

SECTION 01 35 50

REQUESTS FOR ELECTRONIC FILES

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 RELATED SECTIONS

- A. Section 013300 Submittal Procedures for shop drawings, product data and samples.
- B. Section 017700 Closeout Procedures.
- C. Divisions 31 through 33 for Sitework.

1.3 REQUIREMENTS

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 ELECTRONIC FILE TRANSFER PROCEDURE

- A. Submit a check in the amount of \$250.00 along with a list of the requested sheet numbers and an acknowledged copy of this waiver to the office of the Architect, Ruhnau Clarke Architects, 3775 Tenth Street, Riverside, CA 92501.
- B. In order to expedite the transfer, upon receipt of a fax copy of this acknowledgement, the requested CAD files will be sent in the form of a compact disc to the recipient, as requested, by UPS or similar delivery service.
- C. It is expressly understood that any transfer is done as a courtesy and can be revoked at any time by the Architect.

HOLD HARMLESS AGREEMENT

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

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

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

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

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

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

Acknowledged by:

Signature of Company Officer/Date

Print or Type Name/Company Name

Street Address

City, State, Zip Code

E-mail Address

END OF SECTION 013500

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Construction Manager of responsibility for compliance with the Contract Document requirements.
 - 1. Specified tests, inspections, and related actions do not limit Construction Manager's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 2. Requirements for Construction Manager to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
 - 3. Specific test and inspection requirements are not specified in this Section.

1.2 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
 - 1. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.
- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to

establish product performance and compliance with specified requirements. Must also comply with Article 1.2 Paragraph H (below.)

- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency. The testing agency must have DSA LEA Program acceptance.
- I. Installer/Applicator/Erector: Construction Manager or another entity engaged by Construction Manager as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.3 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.4 ACTION SUBMITTALS

- A. Shop Drawings: For mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.
 - 1. Indicate manufacturer and model number of individual components.
 - 2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.5 INFORMATIONAL SUBMITTALS

- A. Construction Manager's Statement of Responsibility: Submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
 - 1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
 - 2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.
- B. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of most recent report on the inspection of the testing agency by DSA LEA Program.

1.6 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.
 - 9. Test and inspection results and an interpretation of test results.
 - 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - 12. Name and signature of laboratory inspector.
 - 13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Field Reports: Prepare written information documenting tests and inspections specified in other Sections. Include the following:
 - 1. Name, address, and telephone number of representative making report.
 - 2. Statement on condition of substrates and their acceptability for installation of product.
 - 3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 - 4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - 5. Other required items indicated in individual Specification Sections.
- C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.7 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.
- A. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329 and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities. Must also comply with Article 1.2 Paragraph H.
 - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- B. Manufacturer's Representative Qualifications: An authorized representative of manufacturer who is trained and approved by an independent, recognized authority to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- A. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
 - 1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
 - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.

- f. When testing is complete, remove test specimens, assemblies, and mockups, and laboratory mockups; do not reuse products on Project.
 - 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- B. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
 - 2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 - 3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
 - 4. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 5. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 - 6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 7. Demolish and remove mockups when directed unless otherwise indicated.
- C. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Specification Sections.

1.8 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
 - 1. Owner will furnish Construction Manager with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
 - 2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Construction Manager, and the Contract Sum will be adjusted by Change Order.
- B. Construction Manager Responsibilities: Tests and inspections not explicitly assigned to Owner are Construction Manager's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
 - 1. Where services are indicated as Construction Manager's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Construction Manager shall not employ same entity engaged by Owner.
 - 2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.

3. Where quality-control services are indicated as Construction Manager's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 4. Testing and inspecting requested by Construction Manager and not required by the Contract Documents are Construction Manager's responsibility.
 5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."
- D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Construction Manager's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- F. Testing Agency Responsibilities: Cooperate with Architect and Construction Manager in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect and Construction Manager promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Construction Manager.
 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 6. Do not perform any duties of Construction Manager.
- G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Delivery of samples to testing agencies.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

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

1.9 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:
 1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
 2. Notifying Architect, Project Inspector, DSA and Construction Manager promptly of irregularities and deficiencies observed in the Work during performance of its services.
 3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect, with copy to Construction Manager and Project Inspector.
 4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
 1. Date test or inspection was conducted.
 2. Description of the Work tested or inspected.
 3. Date test or inspection results were transmitted to Architect.
 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's and Project Inspector's reference during normal working hours.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."
- B. Protect construction exposed by or for quality-control service activities.

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

END OF SECTION 014000

SECTION 01 42 00

REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Construction Manager's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Thomson Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."
- B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

AA	Aluminum Association (The)
AABC	Associated Air Balance Council
AAMA	American Architectural Manufacturers Association
AASHTO	American Association of State Highway and Transportation Officials
AATCC	American Association of Textile Chemists and Colorists
ABAA	Air Barrier Association of America
ABMA	American Bearing Manufacturers Association
ACI	American Concrete Institute
ACPA	American Concrete Pipe Association
AEIC	Association of Edison Illuminating Companies, Inc. (The)
AF&PA	American Forest & Paper Association
AGA	American Gas Association
AHAM	Association of Home Appliance Manufacturers
AHRI	Air-Conditioning, Heating, and Refrigeration Institute, The
AI	Asphalt Institute
AIA	American Institute of Architects (The)
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
ALSC	American Lumber Standard Committee, Incorporated
AMCA	Air Movement and Control Association International, Inc.

ANSI	American National Standards Institute
AOSA	Association of Official Seed Analysts, Inc.
APA	APA - The Engineered Wood Association
APA	Architectural Precast Association
API	American Petroleum Institute
ARI	Air-Conditioning & Refrigeration Institute
ARMA	Asphalt Roofing Manufacturers Association
ASCE	American Society of Civil Engineers
ASCE/SEI	American Society of Civil Engineers/Structural Engineering Institute (See ASCE)
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASME	ASME International (American Society of Mechanical Engineers International)
ASSE	American Society of Sanitary Engineering
ASTM	ASTM International (American Society for Testing and Materials International)
ATIS	Alliance for Telecommunications Industry Solutions
AWCMA	American Window Covering Manufacturers Association (Now WCMA)
AWCI	Association of the Wall and Ceiling Industry
AWI	Architectural Woodwork Institute
AWPA	American Wood Protection Association (Formerly: American Wood Preservers' Association)
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Industry Association (The)
BICSI	BICSI, Inc.
BIFMA	BIFMA International (Business and Institutional Furniture Manufacturer's Association International)
BISSC	Baking Industry Sanitation Standards Committee

CCC	Carpet Cushion Council
CDA	Copper Development Association
CEA	Canadian Electricity Association
CEA	Consumer Electronics Association
CFFA	Chemical Fabrics & Film Association, Inc.
CGA	Compressed Gas Association
CIMA	Cellulose Insulation Manufacturers Association
CISCA	Ceilings & Interior Systems Construction Association
CISPI	Cast Iron Soil Pipe Institute
CLFMI	Chain Link Fence Manufacturers Institute
CPA	Composite Panel Association
CRI	Carpet and Rug Institute (The)
CRRC	Cool Roof Rating Council
CRSI	Concrete Reinforcing Steel Institute
CRRC	Cool Roof Rating Council
CSA	Canadian Standards Association
CSA	CSA International (Formerly: IAS - International Approval Services)
CSI	Construction Specifications Institute (The)
CSSB	Cedar Shake & Shingle Bureau
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute)
DHI	Door and Hardware Institute
ECA	Electrical Components Association
EIA	Electronic Industries Alliance
EIMA	EIFS Industry Members Association
EJCDC	Engineers Joint Contract Documents Committee
EJMA	Expansion Joint Manufacturers Association, Inc.
ESD	ESD Association (Electrostatic Discharge Association)

ETL SEMCO	Intertek ETL SEMCO (Formerly: ITS - Intertek Testing Service NA)
FIBA	Federation Internationale de Basketball (The International Basketball Federation)
FIVB	Federation Internationale de Volleyball (The International Volleyball Federation)
FM Approvals	FM Approvals LLC
FM Global	FM Global (Formerly: FMG - FM Global)
FRSA	Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.
FSA	Fluid Sealing Association
FSC	Forest Stewardship Council
GA	Gypsum Association
GANA	Glass Association of North America
GRI	(Part of GSI)
GS	Green Seal
GSI	Geosynthetic Institute
HI	Hydronics Institute
HI/GAMA	Hydronics Institute/Gas Appliance Manufacturers Association Division of Air-Conditioning, Heating, and Refrigeration Institute (AHRI)
HMMA	Hollow Metal Manufacturers Association (Part of NAAMM)
HPVA	Hardwood Plywood & Veneer Association
HPW	H. P. White Laboratory, Inc.
IAPSC	International Association of Professional Security Consultants
ICC	International Code Council
ICEA	Insulated Cable Engineers Association, Inc.
ICRI	International Concrete Repair Institute, Inc.
ICPA	International Cast Polymer Association
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The)

IES	Illuminating Engineering Society of North America
IEST	Institute of Environmental Sciences and Technology
IGMA	Insulating Glass Manufacturers Alliance
ILI	Indiana Limestone Institute of America, Inc.
ISA	Instrumentation, Systems, and Automation Society, The
ISO	International Organization for Standardization
ISSFA	International Solid Surface Fabricators Association
ITS	Intertek Testing Service NA (Now ETL SEMCO)
ITU	International Telecommunication Union
KCMA	Kitchen Cabinet Manufacturers Association
LGSEA	Light Gauge Steel Engineers Association
LMA	Laminating Materials Association (Now part of CPA)
LPI	Lightning Protection Institute
MBMA	Metal Building Manufacturers Association
MCA	Metal Construction Association
MFMA	Maple Flooring Manufacturers Association, Inc.
MFMA	Metal Framing Manufacturers Association, Inc.
MH	Material Handling (Now MHIA)
MHIA	Material Handling Industry of America
MIA	Marble Institute of America
MPI	Master Painters Institute
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc.
NAAMM	National Association of Architectural Metal Manufacturers
NACE	NACE International (National Association of Corrosion Engineers International)
NADCA	National Air Duct Cleaners Association
NAGWS	National Association for Girls and Women in Sport

NAIMA	North American Insulation Manufacturers Association
NBGQA	National Building Granite Quarries Association, Inc.
NCAA	National Collegiate Athletic Association (The)
NCMA	National Concrete Masonry Association
NCTA	National Cable & Telecommunications Association
NEBB	National Environmental Balancing Bureau
NECA	National Electrical Contractors Association
NeLMA	Northeastern Lumber Manufacturers' Association
NEMA	National Electrical Manufacturers Association
NETA	InterNational Electrical Testing Association
NFHS	National Federation of State High School Associations
NFPA	NFPA (National Fire Protection Association)
NFRC	National Fenestration Rating Council
NGA	National Glass Association
NHLA	National Hardwood Lumber Association
NLGA	National Lumber Grades Authority
NOFMA	NOFMA: The Wood Flooring Manufacturers Association (Formerly: National Oak Flooring Manufacturers Association)
NOMMA	National Ornamental & Miscellaneous Metals Association
NRCA	National Roofing Contractors Association
NRMCA	National Ready Mixed Concrete Association
NSF	NSF International (National Sanitation Foundation International)
NSSGA	National Stone, Sand & Gravel Association
NTMA	National Terrazzo & Mosaic Association, Inc. (The)
NWFA	National Wood Flooring Association
PCI	Precast/Prestressed Concrete Institute
PDI	Plumbing & Drainage Institute

PGI	PVC Geomembrane Institute
PTI	Post-Tensioning Institute
RCSC	Research Council on Structural Connections
RFCI	Resilient Floor Covering Institute
RIS	Redwood Inspection Service
SAE	SAE International
SCAQMD	South Coast Air Quality Management District
SCTE	Society of Cable Telecommunications Engineers
SDI	Steel Deck Institute
SDI	Steel Door Institute
SEFA	Scientific Equipment and Furniture Association
SEI/ASCE	Structural Engineering Institute/American Society of Civil Engineers (See ASCE)
SIA	Security Industry Association
SJI	Steel Joist Institute
SMA	Screen Manufacturers Association
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SMPTE	Society of Motion Picture and Television Engineers
SPFA	Spray Polyurethane Foam Alliance (Formerly: SPI/SPFD - The Society of the Plastics Industry, Inc.; Spray Polyurethane Foam Division)
SPIB	Southern Pine Inspection Bureau (The)
SPRI	Single Ply Roofing Industry
SSINA	Specialty Steel Industry of North America
SSPC	SSPC: The Society for Protective Coatings
STI	Steel Tank Institute
SWI	Steel Window Institute
SWPA	Submersible Wastewater Pump Association
TCA	Tilt-Up Concrete Association

TCNA	Tile Council of North America, Inc.
TEMA	Tubular Exchanger Manufacturers Association
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance
TMS	The Masonry Society
TPI	Truss Plate Institute, Inc.
TPI	Turfgrass Producers International
TRI	Tile Roofing Institute
UL	Underwriters Laboratories Inc.
UNI	Uni-Bell PVC Pipe Association
USAV	USA Volleyball
USGBC	U.S. Green Building Council
USITT	United States Institute for Theatre Technology, Inc.
WASTEC	Waste Equipment Technology Association
WCLIB	West Coast Lumber Inspection Bureau
WCMA	Window Covering Manufacturers Association
WDMA	Window & Door Manufacturers Association (Formerly: NWWDA - National Wood Window and Door Association)
WI	Woodwork Institute (Formerly: WIC - Woodwork Institute of California)
WMMPA	Wood Moulding & Millwork Producers Association
WSRCA	Western States Roofing Contractors Association
WWPA	Western Wood Products Association

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

DIN	Deutsches Institut für Normung e.V.
IAPMO	International Association of Plumbing and Mechanical Officials
ICC	International Code Council
ICC-ES	ICC Evaluation Service, Inc.

- D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

COE	Army Corps of Engineers
CPSC	Consumer Product Safety Commission
DOC	Department of Commerce
DOD	Department of Defense
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FDA	Food and Drug Administration
GSA	General Services Administration
HUD	Department of Housing and Urban Development
LBL	Lawrence Berkeley National Laboratory
NCHRP	National Cooperative Highway Research Program (See TRB)
NIST	National Institute of Standards and Technology
OSHA	Occupational Safety & Health Administration
PBS	Public Buildings Service (See GSA)
PHS	Office of Public Health and Science
RUS	Rural Utilities Service (See USDA)
SD	State Department
TRB	Transportation Research Board
USDA	Department of Agriculture
USP	U.S. Pharmacopeia
USPS	Postal Service

E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list.

ADAAG	Americans with Disabilities Act (ADA) Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities Available from U.S. Access Board
CFR	Code of Federal Regulations Available from Government Printing Office
DOD	Department of Defense Military Specifications and Standards Available from Department of Defense Single Stock Point
DSCC	Defense Supply Center Columbus (See FS)
FED-STD	Federal Standard (See FS)
FS	Federal Specification Available from Department of Defense Single Stock Point Available from Defense Standardization Program Available from General Services Administration Available from National Institute of Building Sciences
FTMS	Federal Test Method Standard (See FS)
MIL	(See MILSPEC)
MIL-STD	(See MILSPEC)
MILSPEC	Military Specification and Standards Available from Department of Defense Single Stock Point
UFAS	Uniform Federal Accessibility Standards Available from Access Board

F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

CBHF	State of California, Department of Consumer Affairs Bureau of Home Furnishings and Thermal Insulation
CCR	California Code of Regulations
CDHS	California Department of Health Services
CDPH	California Department of Public Health, Indoor Air Quality Section

CPUC California Public Utilities Commission

TFS Texas Forest Service
Forest Resource Development

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
 - 1. Section 01 10 00 "Summary" for work restrictions and limitations on utility interruptions.

1.2 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.
- B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
- C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.3 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Construction Manager personnel responsible for management of fire prevention program.

1.4 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

- C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and CCR Title 24.

1.5 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide concrete or galvanized-steel bases for supporting posts.

2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

2.3 EQUIPMENT

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

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
- C. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- D. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
 - 1. Connect temporary service to Owner's existing power source, as directed by Owner.
- E. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
- F. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel.
- G. Electronic Communication Service: Provide a Lenovo T450 Ultrabook laptop computer in the primary field office, adequate for use by Architect and Owner to access project electronic documents and maintain electronic communications. Laptop computer to be handed over to Owner at Substantial Completion. Equip laptop computer with not less than the following:
 - 1. Base Unit: ThinkPad T450.
 - 2. Operating System: Windows 8.1 64.
 - 3. Display: 14"HD+ (1600 x 900) LED Backlit Display ,Multitouch (w/WWAN).
 - 4. Processor: 4th Gen Intel Core i5-4300U Processor (3MB Cache, up to 2.90GHz).
 - 5. Hard Drive: 128GB Solid State Drive.
 - 6. Memory: 4GB PC3-12800.
 - 7. Wireless: Intel 7265 AC/B/G/N Dual Band Wireless + Bluetooth Version 4.0.
 - 8. Camera: 720p HD Camera.
 - 9. Battery: ThinkPad Battery 3 cell Li-Ion (23.2Whr) Front - ThinkPad Battery 6 cell Li-Ion (47Whr) Cylindrical.
 - 10. Keyboard: UltraNav (TrackPoint and TouchPad).
 - 11. Productivity Software (provide current versions):
 - a. Microsoft Office Professional, including Word, Excel, and Outlook.
 - b. Adobe Reader.
 - c. Door hardware software.
 - 12. Internet Service: Broadband modem, router and ISP, equipped with hardware firewall.
 - 13. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.
 - 14. Warranty: Provide a 3-year Onsite Warranty.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

C. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

D. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.

E. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs as indicated on Drawings.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
3. Maintain and touchup signs so they are legible at all times.

F. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

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

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

- E. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
 - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
- F. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.
- G. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- H. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- I. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
- J. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire prevention program.
 - 1. Prohibit smoking in construction areas.
 - 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 - 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
 - 4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 MOISTURE AND MOLD CONTROL

- A. Construction Manager's Moisture Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.
- B. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
 - 1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 - 2. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are property of Construction Manager. Owner reserves right to take possession of Project identification signs.
 2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 012500 "Substitution Procedures" for requests for substitutions.

1.2 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

1.3 ACTION SUBMITTALS

- A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Construction Manager of approval or rejection of proposed comparable product request within seven days of receipt of request.
 - a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
 - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

1.4 QUALITY ASSURANCE

- A. Compatibility of Options: If Construction Manager is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:
 - 1. Store products to allow for inspection and measurement of quantity or counting of units.
 - 2. Store materials in a manner that will not endanger Project structure.
 - 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 - 4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 - 5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 6. Protect stored products from damage and liquids from freezing.

1.6 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Construction Manager of obligations under requirements of the Contract Documents.
 - 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 - 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. Refer to other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

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

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Construction Manager's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Construction Manager's convenience will not be considered.
3. Products:
 - a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Construction Manager's convenience will be not considered.
 - b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
4. Manufacturers:
 - a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with

requirements. Comparable products or substitutions for Construction Manager's convenience will not be considered.

- b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
- C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
 - 1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration: Architect will consider Construction Manager's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
 - 1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 - 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - 3. Evidence that proposed product provides specified warranty.
 - 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 - 5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 01 73 00

EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. Installation of the Work.
 - 4. Cutting and patching.
 - 5. Coordination of Owner-installed products.
 - 6. Progress cleaning.
 - 7. Starting and adjusting.
 - 8. Protection of installed construction.
 - 9. Correction of the Work.
- B. Related Requirements:
 - 1. Section 01 10 00 "Summary" for limits on use of Project site.
 - 2. Section 01 77 00 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
 - 3. Section 07 84 00 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.2 INFORMATIONAL SUBMITTALS

- A. Certificates: Submit certificate signed by professional engineer certifying that location and elevation of improvements comply with requirements.

1.3 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.
- B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 - 1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection

2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.

2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Construction Manager, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to layout the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
- B. General: Engage a professional engineer to layout the Work using accepted surveying practices.
1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 2. Establish limits on use of Project site.
 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 4. Inform installers of lines and levels to which they must comply.
 5. Check the location, level and plumb, of every major element as the Work progresses.
 6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and layout site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

- D. Building Lines and Levels: Locate and layout control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

- A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
- B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
 - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
- C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that

adequate provisions are made for locating and installing products to comply with indicated requirements.

- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 3. Concrete: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 6. Proceed with patching after construction operations requiring cutting are complete.
- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.

2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements"

3.9 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Salvaging nonhazardous demolition and construction waste.
 - 2. Recycling nonhazardous demolition and construction waste.
 - 3. Disposing of nonhazardous demolition and construction waste.
- B. Related Requirements:
 - 1. Section 04 2 200 "Concrete Unit Masonry" for disposal requirements for masonry waste.
 - 2. Section 04 43 13 "Adhered Stone Masonry Veneer" for disposal requirements for excess stone and stone waste.
 - 3. Section 31 10 00 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.2 DEFINITIONS

- A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.
- C. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner's property.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.3 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition and construction waste becomes property of Contractor.

1.4 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 7 days of date established for commencement of the Work.

1.5 INFORMATIONAL SUBMITTALS

- A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:
 - 1. Material category.
 - 2. Generation point of waste.
 - 3. Total quantity of waste in tons.
 - 4. Quantity of waste salvaged, both estimated and actual in tons.
 - 5. Quantity of waste recycled, both estimated and actual in tons.
 - 6. Total quantity of waste recovered (salvaged plus recycled) in tons.
 - 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. Qualification Data: For waste management coordinator.

1.6 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with transportation and disposal regulations of authorities having jurisdiction.
- A. Waste Management Conference(s): Conduct conference(s) at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
 - 1. Review and discuss waste management plan including responsibilities of each contractor and waste management coordinator.
 - 2. Review requirements for documenting quantities of each type of waste and its disposition.

3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.7 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
 1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work in compliance with Section 02 41 16 "Structure Demolition."
 2. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 3. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
 4. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

PART 2 - PRODUCTS

2.1 RECYCLING RECEIVERS AND PROCESSORS

- A. Subject to compliance with requirements, available recycling receivers and processors include, but are not limited to, the following:
 1. A waste management company that can provide verifiable documentation that the percentage of construction and demolition waste material diverted from the landfill complies with this Section.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Achieve end-of-Project rates for salvage/recycling of 50 percent by weight of total nonhazardous solid waste generated by the Work in accordance with CCR Section 5.408.1.1, 5.408.1.2 or 5.408.1.3; or meet a local construction and demolition waste management ordinance, whichever is more stringent.

1. The combined weight of new construction disposal that does not exceed two pounds per square foot of building area may be deemed to meet the 50 percent minimum requirement as approved by the enforcing agency.
- B. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials.

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
 1. Distribute waste management plan to everyone concerned within three days of submittal return.
 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
 2. Comply with Section 01 50 00 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

- A. Comply with requirements in Section 02 41 16 "Structure Demolition" for salvaging demolition waste.
- B. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:
 1. Clean salvaged items.
 2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
 3. Store items in a secure area until installation.
 4. Protect items from damage during transport and storage.
 5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

- C. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.
- D. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
- E. Plumbing Fixtures: Separate by type and size.
- F. Lighting Fixtures: Separate lamps by type and protect from breakage.
- G. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Owner.
- C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.
- D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
 - 1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - a. Inspect containers and bins for contamination and remove contaminated materials if found.
 - 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 - 4. Store components off the ground and protect from the weather.
 - 5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor as often as required to prevent overfilling bins.

3.4 RECYCLING DEMOLITION WASTE

- A. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.
- B. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
- C. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
 - 1. Clean and stack undamaged, whole masonry units on wood pallets.

- D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
- E. Metals: Separate metals by type.
 - 1. Structural Steel: Stack members according to size, type of member, and length.
 - 2. Remove and dispose of bolts, nuts, washers, and other rough hardware.
- F. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.
- G. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
- H. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.
- I. Metal Suspension System: Separate metal members, including trim and other metals from acoustical panels and tile, and sort with other metals.
- J. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
 - 1. Store clean, dry carpet and pad in a closed container or trailer provided by carpet reclamation agency or carpet recycler.
- K. Carpet Tile: Remove debris, trash, and adhesive.
 - 1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by carpet reclamation agency or carpet recycler.
- L. Piping: Reduce piping to straight lengths and store by material and size. Separate supports, hangers, valves, sprinklers, and other components by material and size.
- M. Conduit: Reduce conduit to straight lengths and store by material and size.
- N. Lamps: Separate lamps by type and store according to requirements in 40 CFR 273.

3.5 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
 - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 - 2. Polystyrene Packaging: Separate and bag materials.
 - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Wood Materials:
 - 1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
 - 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

- C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
- D. Paint: Seal containers and store by type.

3.6 DISPOSAL OF WASTE

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

END OF SECTION 017419

SECTION 01 70 00

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
 - 5. Repair of the Work.

1.2 ACTION SUBMITTALS

- A. Product Data: For cleaning agents.
- B. Construction Manager's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest control inspection.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.5 SUBSTANTIAL COMPLETION PROCEDURES

- A. Construction Manager's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Construction Manager's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
 5. Submit test/adjust/balance records.
 6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 3. Complete startup and testing of systems and equipment.
 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
 6. Advise Owner of changeover in heat and other utilities.
 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 9. Complete final cleaning requirements, including touchup painting.
 10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Construction Manager of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Construction Manager of items, either on Construction Manager's list or additional items identified by Architect that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for final completion.

1.6 FINAL COMPLETION PROCEDURES

- A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Submit pest-control final inspection report and warranty.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. Inspection: Submit a written request for final inspection to determine acceptance. On receipt of request, Architect will either proceed with inspection or notify Construction Manager of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Construction Manager of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Construction Manager that are outside the limits of construction.
1. Organize list of spaces in sequential order.
 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 3. Submit list of incomplete items in electronic format acceptable to Architect:
 - a. Architect will return annotated copy.

1.8 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Construction Manager.

4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - g. Sweep concrete floors broom clean in unoccupied spaces.
 - h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials.

- Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - j. Remove labels that are not permanent.
 - k. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - l. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - m. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - n. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
 - o. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
- 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
 - 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

SECTION 01 78 00

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.

1.2 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit one set(s) of marked-up record prints.
- B. Record Specifications: Submit one paper copy of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit one paper copy of each submittal.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised Drawings as modifications are issued.
 - 1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - 2. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 - 3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 - 4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Note related Change Orders, record Product Data, and record Drawings where applicable.
- B. Format: Submit record Specifications as paper copy.

2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
- B. Format: Submit record Product Data as paper copy.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 017800

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory.
 - 2. Emergency manuals.
 - 3. Operation manuals for systems, subsystems, and equipment.
 - 4. Product maintenance manuals.
 - 5. Systems and equipment maintenance manuals.
- B. Related Requirements:
 - 1. Section 01 33 00 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.2 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.3 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operations and maintenance manuals in the following format:
 - 1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
 - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
 - b. Enable inserted reviewer comments on draft submittals.

- C. Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
 - 1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information.
- B. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 - 1. Title page.
 - 2. Table of contents.
 - 3. Manual contents.
- C. Title Page: Include the following information:
 - 1. Subject matter included in manual.
 - 2. Name and address of Project.
 - 3. Name and address of Owner.
 - 4. Date of submittal.
 - 5. Name and contact information for Contractor.
 - 6. Name and contact information for Architect.
 - 7. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 - 8. Cross-reference to related systems in other operation and maintenance manuals.
- D. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
- E. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- F. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
 - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 - 2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each

system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

G. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.
2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.2 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
 - 1. Instructions on stopping.
 - 2. Shutdown instructions for each type of emergency.
 - 3. Operating instructions for conditions outside normal operating limits.
 - 4. Required sequences for electric or electronic systems.
 - 5. Special operating instructions and procedures.

2.3 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
 - 1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 - 2. Performance and design criteria if Contractor is delegated design responsibility.
 - 3. Operating standards.
 - 4. Operating procedures.
 - 5. Operating logs.
 - 6. Wiring diagrams.
 - 7. Control diagrams.
 - 8. Piped system diagrams.
 - 9. Precautions against improper use.
 - 10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
 - 1. Product name and model number. Use designations for products indicated on Contract Documents.
 - 2. Manufacturer's name.
 - 3. Equipment identification with serial number of each component.
 - 4. Equipment function.
 - 5. Operating characteristics.
 - 6. Limiting conditions.
 - 7. Performance curves.
 - 8. Engineering data and tests.
 - 9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
 - 1. Startup procedures.
 - 2. Equipment or system break-in procedures.
 - 3. Routine and normal operating instructions.
 - 4. Regulation and control procedures.
 - 5. Instructions on stopping.
 - 6. Normal shutdown instructions.
 - 7. Seasonal and weekend operating instructions.
 - 8. Required sequences for electric or electronic systems.
 - 9. Special operating instructions and procedures.

- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.4 PRODUCT MAINTENANCE MANUALS

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Product Information: Include the following, as applicable:
 - 1. Product name and model number.
 - 2. Manufacturer's name.
 - 3. Color, pattern, and texture.
 - 4. Material and chemical composition.
 - 5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection procedures.
 - 2. Types of cleaning agents to be used and methods of cleaning.
 - 3. List of cleaning agents and methods of cleaning detrimental to product.
 - 4. Schedule for routine cleaning and maintenance.
 - 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.
 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 3. Identification and nomenclature of parts and components.
 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
 2. Troubleshooting guide.
 3. Precautions against improper maintenance.
 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 5. Aligning, adjusting, and checking instructions.
 6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
- D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
- E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence

and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.
- F. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 01 79 00

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

1.3 CLOSEOUT SUBMITTALS

- A. At completion of training, submit complete training manual(s) for Owner's use prepared and bound in format matching operation and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to demonstration and training.

1.5 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 - 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Operations manuals.
 - c. Maintenance manuals.
 - d. Project record documents.
 - e. Identification systems.
 - f. Warranties and bonds.
 - g. Maintenance service agreements and similar continuing commitments.
 - 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
 - 4. Operations: Include the following, as applicable:

- a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
- a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
- a. Diagnostic instructions.
 - b. Test and inspection procedures.
7. Maintenance: Include the following:
- a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
8. Repairs: Include the following:
- a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."

3.2 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Owner will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner with at least seven days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral performance-based test.

END OF SECTION 017900

SECTION 01 81 13

SUSTAINABLE DESIGN REQUIREMENTS - CALGREEN

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following: General requirements and procedures for compliance with the California Green Building Standards Code.
 - 1. Other CALGreen requirements depend on product selections and may not be specifically identified as CALGreen requirements. Compliance with CALGreen requirements will be used as one criterion to evaluate substitution requests and comparable product requests.
 - 2. Specific CALGreen requirements are also included in other Sections.
- B. Related Sections:
 - 1. Section 01 50 00 "Temporary Facilities and Controls" for additional stormwater control requirements.
 - 2. Section 23 08 00 "Commissioning of Heating, Ventilating and Air Conditioning Systems" for Commissioning required by CALGreen.

1.02 DEFINITIONS

- A. 2016 California Green Building Standards Code (Part 11 of California Code of Regulations, Title 24): CALGreen.
 - 1. Where Code Sections are referenced herein without Code identification, they are Code Sections of CALGreen.

1.03 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site. Review CALGreen requirements and action plans for compliance with requirements.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Respond to questions and requests from Architect about CALGreen requirements that are the responsibility of Contractor, that depend on product selection or product qualities, or that depend on Contractor's procedures. Document responses as informational submittals.

1.05 ACTION SUBMITTALS

- A. General: Submit additional sustainable design submittals required by other Specification Sections.
- B. Sustainable design submittals are in addition to other submittals.

1. If submitted item is identical to that submitted to comply with other requirements, include an additional copy with other submittal as a record copy of compliance with indicated CALGreen requirements instead of separate sustainable design submittal. Mark additional copy "CALGreen submittal."

1.06 INFORMATIONAL SUBMITTALS

- A. Action Plans: Submit the following action plans within seven days of date established for the Notice of Award indicating how requirements will be met.
 1. Waste management plan complying with Section 01 74 19 "Construction Waste Management and Disposal."
 2. Construction indoor-air-quality management plan.
- B. Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction activities with action plans.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

- A. Provide products and procedures necessary to comply with requirements in this Section for material selection and material emissions and pollutant control. Although other Sections may specify some requirements for material selection and material emissions and pollutant control, Contractor shall provide additional materials and procedures necessary to comply with requirements.

2.02 POLLUTANT CONTROL

- A. Finish Material Pollutant Control per Section 5.504.4:
 1. Adhesives, Sealants, and Caulks: Adhesives, adhesive bonding primers adhesive primers, sealants, sealant primers and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, as shown in Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with the Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene and trichloroethylene), except for aerosol products as follows:
 - a. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.
 2. Adhesive and Sealant VOC Limits per Tables 5.504.4.1 and 5.504.4.2:
 - a. Wood Glues: 30 g/L.
 - b. Metal-to-Metal Adhesives: 30 g/L.
 - c. Adhesives for Porous Materials (except Wood): 50 g/L.

- d. Subfloor Adhesives: 50 g/L.
- e. Plastic Foam Adhesives: 50 g/L.
- f. Carpet Adhesives: 50 g/L.
- g. Carpet Pad Adhesives: 50 g/L.
- h. VCT and Asphalt Tile Adhesives: 50 g/L.
- i. Cove Base Adhesives: 50 g/L.
- j. Gypsum Board and Panel Adhesives: 50 g/L.
- k. Rubber Floor Adhesives: 60 g/L.
- l. Ceramic Tile Adhesives: 65 g/L.
- m. Multipurpose Construction Adhesives: 70 g/L.
- n. Fiberglass Adhesives: 60 g/L.
- o. Contact Adhesive: 60 g/L.
- p. Structural Glazing Adhesives: 100 g/L.
- q. Wood Flooring Adhesive: 100 g/L.
- r. Structural Wood Member Adhesive: 140 g/L.
- s. Single-Ply Roof Membrane Adhesive: 250 g/L.
- t. Special-Purpose Contact Adhesive (Contact Adhesive That Is Used to Bond Melamine Covered Board, Metal, Unsupported Vinyl, Rubber, or Wood Veneer 1/16 Inch or Less in Thickness to Any Surface): 250 g/L.
- u. Top and Trim Adhesive: 250 g/L.
- v. Plastic Cement Welding Compounds: 250 g/L.
- w. ABS Welding Compounds: 325 g/L.
- x. CPVC Welding Compounds: 490 g/L.
- y. PVC Welding Compounds: 510 g/L.
- z. Adhesive Primer for Plastic: 550 g/L.
- aa. Other Adhesives: 50 g/L.
- bb. Architectural Sealants: 250 g/L.
- cc. Nonmembrane Roof Sealants: 300 g/L.
- dd. Single-Ply Roof Membrane Sealants: 450 g/L.
- ee. Other Sealants: 420 g/L.
- ff. Sealant Primers for Nonporous Substrates: 250 g/L.
- gg. Sealant Primers for Porous Substrates: 775 g/L.
- hh. Modified Bituminous Sealant Primers: 500 g/L.
- ii. Other Sealant Primers: 750 g/L.

B. Paints and Coatings:

1. Architectural paints and coatings shall comply with VOC limits in Table 1 of the ARB Architectural Coatings Suggested Control Measure, as shown in Table 5.504.4.3, unless more stringent local limits apply. The VOC content limit for coatings that do not meet the definitions for the specialty coatings categories listed in Table 5.504.4.3 shall be determined by classifying the coating as a Flat, Nonflat or Nonflat-High Gloss coating, based on its gloss, as defined in Subsections 4.21, 4.36 and 4.37 or the 2007 California Air Resources Board Suggested Control Measure, and the corresponding Flat, Nonflat or Nonflat-High Gloss VOC limit in Table 5.504.4.3 shall apply.
2. Aerosol Paints And Coatings:
 - a. Aerosol paints and coatings shall meet the PWMIR Limits for ROC in Section 94522(a)(3) and other requirements, including prohibitions on use of certain toxic compounds and ozone depleting substances, in Sections 94522(c)(2) and (d)(2) of California Code of Regulations, Title 17, commencing with section 94520; and in areas under the jurisdiction of the Bay Area Air Quality Management District additionally comply with the percent VOC by weight of product limits of Regulation 8 Rule 49.
 - b. Verification of compliance with this section shall be provided at the request of the enforcing agency. Documentation may include, but is not limited to, the following:

- 1) Manufacturer's product specification
 - 2) Field verification of on-site product containers
3. VOC Content Limits for Architectural Coatings per Table 5.504.4.3:

- a. Flat Coatings: 50 g/L.
- b. Nonflat Coatings: 100 g/L.
- c. Nonflat High Gloss Coatings: 150 g/L.
- d. Aluminum Roof Coating: 400 g/L.
- e. Basement Specialty Coating: 400 g/L.
- f. Bituminous Roof Coating: 50 g/L.
- g. Bituminous Roof Primers: 350 g/L.
- h. Bond Breakers: 350 g/L.
- i. Concrete Curing Compounds: 350 g/L.
- j. Concrete/ Masonry Sealers: 100 g/L.
- k. Driveway Sealers: 50 g/L.
- l. Dry Fog Coatings: 150 g/L.
- m. Faux Finishing Coatings: 350 g/L.
- n. Fire Resistive Coatings: 350 g/L.
- o. Floor Coatings: 100 g/L.
- p. Form-Release Compound: 250 g/L.
- q. Graphic Art Coatings (Sign Paint): 500 g/L.
- r. High-Temperature Coatings: 420 g/L.
- s. Industrial Maintenance Coatings: 250 g/L.
- t. Low Solids Coatings: 120 g/L.
- u. Magnesite Cement Coatings: 450 g/L.
- v. Mastic Texture Coatings: 100 g/L.
- w. Metallic Pigmented Coatings: 500 g/L.
- x. Multicolor Coatings: 250 g/L.
- y. Pretreatment Wash Primers: 420 g/L.
- z. Primers, Sealers and Undercoats: 100 g/L.
- aa. Reactive Penetrating Sealers: 350 g/L.
- bb. Recycled Coatings: 250 g/L.
- cc. Roof Coatings: 50 g/L.
- dd. Rust Preventative Coatings: 250 g/L.
- ee. Shellacs, Clear: 730 g/L.
- ff. Shellacs, Opaque: 550 g/L.
- gg. Specialty Primers, Sealers and Undercoats: 100 g/L.
- hh. Stains: 250 g/L.
- ii. Stone Consolidants: 450 g/L.
- jj. Swimming Pools Coating: 340 g/L.
- kk. Traffic Marking Coatings: 100 g/L.
- ll. Tub And Tile Refinish Coatings: 420 g/L.
- mm. Water Proofing Membranes: 250 g/L.
- nn. Wood Coating: 275 g/L.
- oo. Wood Preservatives: 350 g/L.
- pp. Zinc-Rich Primers: 340 g/L.

- C. Carpet Systems: All carpet installed in the building interior shall meet at least one of the testing and product requirements of Section 5.504.4.4.
1. Carpet Cushion: All carpet cushion installed in the building interior shall meet the requirements of the Carpet and Rug Institute's Green Label Program.
 2. Carpet Adhesive: All carpet adhesive shall meet the requirements of Table 5.504.4.1.

- D. Composite Wood Products: Hardwood plywood, particleboard and medium density fiberboard composite wood products used on the interior or exterior of the building shall meet the requirements for formaldehyde as specified in ARB's Air Toxics Control Measure (ATCM) for Composite Wood (17 CCR 93120 et seq.) Those materials not exempted under the ATCM must meet the specified emission limits, as shown in Table 5.504.4.5 below.
 - 1. Verification of compliance with this Section shall be provided as requested by the enforcing agency. Documentation shall include at least one of the five items listed in Section 5.504.4.5.3:
 - 2. Formaldehyde Limits (in parts per million) per Table 5.504.4.5:
 - a. Hardwood Plywood Veneer Core: 0.05 ppm.
 - b. Hardwood Plywood Composite Core: 0.05 ppm.
 - c. Particle Board: 0.09 ppm.
 - d. Medium Density Fiberboard: 0.11 ppm.
 - e. Thin Medium Density Fiberboard: 0.13 ppm.
- E. Resilient Flooring Systems: For 80 percent of floor area receiving resilient flooring, installed resilient flooring shall meet at least one of the four items listed in Section 5.504.4.6.
 - 1. Documentation shall be provided verifying that resilient flooring materials meet the pollutant emissions limits.
- F. Filters: In mechanically ventilated buildings, provide regularly occupied areas of the building with air filtration media for outside and return air that provides at least a MERV of 8. MERV 8 filters shall be installed prior to occupancy, and recommendations for maintenance with filters of the same value shall be included in the operation and maintenance manual.
 - 1. Installed filters shall be clearly labeled by the manufacturer indicating the MERV rating.
- G. Environmental Tobacco Smoke (ETS) Control: Where outdoor areas are provided for smoking, prohibit smoking within 25 feet of building entries, outdoor air intakes and operable windows and within the building as already prohibited by other laws or regulations; or as enforced by ordinances, regulations or policies of any city, county, whichever are more stringent. When ordinances, regulations or policies are not in place, post signage to inform building occupants of the prohibitions.

2.03 INDOOR MOISTURE CONTROL

- A. Buildings shall meet or exceed the provisions of California Building Code, CCR, Title 24, Part 2, Sections 1203 (Ventilation) and Chapter 14 (Exterior Walls).

2.04 INDOOR AIR QUALITY

- A. Outside Air Delivery: For mechanically or naturally ventilated spaces in buildings, meet the minimum requirements of Section 120.1 (Requirements for Ventilation) of the 2013 California Energy Code, or the applicable local code, whichever is more stringent, and Division 1, Chapter 4 of CCR, Title 8.
- B. Carbon Dioxide (CO₂) Monitoring: For buildings or additions equipped with demand control ventilation, CO₂ sensors and ventilation controls shall be specified and installed in accordance with the requirements of the 2013 California Energy Code, CCR, Section 120(c)(4).

2.05 ENVIRONMENTAL COMFORT

- A. Acoustical Control: Employ building assemblies and components with Sound Transmission Class (STC) values determined in accordance with ASTM E90 and ASTM E413 or Outdoor-Indoor Sound Transmission Class (OITC) determined in accordance with ASTM E1332, using either the prescriptive or performance method in Section 5.507.4.1 or 5.507.4.2.
 - 1. Exception: For public schools the requirements of Section 5.507.4 and all subsections apply only to new construction.
- B. Exterior Noise Transmission, Prescriptive Method: Wall and floor-ceiling assemblies exposed to the noise source making up the building envelope shall have exterior wall and roof ceiling assemblies meeting a composite STC rating of at least 50 or a composite OITC rating of no less than 40 with exterior windows of a minimum STC 40 or OITC of 30 in the locations described in items 1 and 2.
- C. Noise Exposure Where Noise Contours Are Not Readily Available: Buildings exposed to a noise level of 65 dB L_{eq} - 1Hr during any hour of operation shall have exterior wall and roof-ceiling assemblies exposed to the noise source meeting a composite STC rating of at least 45 (or OITC 35), with exterior windows of a minimum STC of 40 (or OITC 30).
- D. Performance Method: For buildings located as defined in Section 5.507.4.1 or 5.507.4.1.1, wall and roof-ceiling assemblies exposed to the noise source making up the building or addition envelope or altered envelope shall be constructed to provide an interior noise environment attributable to exterior sources that does not exceed an hourly equivalent noise level (L_{eq} - 1Hr) of 50 dBA in occupied areas during any hour of operation.
- E. Site Features: Exterior features such as sound walls or earth berms may be utilized as appropriate to the project to mitigate sound migration to the interior.
- F. Documentation of Compliance: An acoustical analysis documenting complying interior sound levels shall be prepared by personnel approved by the architect or engineer of record.
- G. Interior Sound Transmission: Wall and floor-ceiling assemblies separating tenant spaces and tenant spaces and public places shall have an STC of at least 40.

2.06 OUTDOOR AIR QUALITY

- A. Ozone Depletion and Greenhouse Gas Reductions: Installations of HVAC, refrigeration and fire suppression equipment shall comply with Sections 5.508.1.1 and 5.508.1.2.
- B. Chlorofluorocarbons (CFCs): Install HVAC, refrigeration and fire suppression equipment that do not contain CFCs.
- C. Halons: Install HVAC, refrigeration and fire suppression equipment that do not contain Halons.

2.07 WEATHER RESISTANCE AND MOISTURE MANAGEMENT

- A. Weather Protection: Per Section 5.407.1, provide a weather-resistant exterior wall and foundation envelope as required by California Building Code Section 1403.2 and California Energy Code Section 150, manufacturer's installation instructions, or local ordinance, whichever is more stringent.

- B. Moisture Control: Per Section 5.407.2, employ moisture control measures by the following methods:

1. Sprinklers: Prevent irrigation spray on structures.
2. Entries and Openings: Design exterior entries and openings to prevent water intrusion into building.
 - a. Exterior Door Protection: Primary exterior entries shall be covered to prevent water intrusion by using nonabsorbent floor and wall finishes within at least 2 feet around and perpendicular to such openings plus at least one of the Items 1 through 4 listed in Section 5.407.2.2.1.
 - b. Flashing: Install flashings integrated with a drainage plane.

2.08 SITE DEVELOPMENT

- A. Stormwater Pollution Prevention: Newly constructed projects and additions which disturb less than one acre of land shall prevent the pollution of stormwater runoff from the construction activities through one or more of the measures described in Section 5.106.1.1 and 5.106.1.2.
- B. Bicycle Parking: For public schools and community colleges, comply with Sections 5.106.4.2.1 and 5.106.4.2.2.
1. Student Bicycle Parking: Provide permanently anchored bicycle racks conveniently accessed with a minimum of four two-bike capacity racks per new building.
 2. Staff Bicycle Parking: Provide permanent, secure bicycle parking conveniently accessed with a minimum of two staff bicycle parking spaces per new building. Acceptable bicycle parking facilities shall be convenient from the street or staff parking area and shall meet one of the following:
 - a. Covered, lockable enclosure with permanently anchored racks for bicycles;
 - b. Lockable bicycle rooms with permanently anchored racks; or
 - c. Lockable, permanently anchored bicycle lockers.
- C. Designated Parking for Clean Air Vehicles: Provide 10 percent designated parking for any combination of low-emitting, fuel-efficient and carpool/van pool vehicles per Table 5.106.5.2.
- D. Electric Vehicle (EV) Charging: Construction shall comply with Section 5.106.5.3.1 or 5.106.5.3.2 to facilitate future installation of electric vehicle supply equipment (EVSE). When EVSE(s) is/are installed, it shall be in accordance with the California Building Code, the California Electrical code and Section 5.106.5.3.
- E. Electrical Vehicle EV Charging Space Calculation:
1. Table 5.106.5.3.3 shall be used to determine if single or multiple charging space requirements apply for the future installation of EVSE, with the exceptions noted in Section 5.106.5.3.3.
 2. Identification: The service panel or subpanel(s) circuit directory shall identify the reserved overcurrent protective device space(s) for future EV charging as "EV CAPABLE". The raceway termination location shall be permanently and visibly marked as "EV CAPABLE."
 3. Future charging spaces qualify as designated parking as described in Section 5.106.5.2 Designated parking for clean air vehicles.

- F. Light Pollution Reduction: Outdoor lighting systems shall be designed and installed to comply with the following:
1. The minimum requirements in the California Energy Code for lighting zones 1-4 as defined in Chapter 10 of the California Administrative Code; and
 2. Backlight, uplight and glare (BUG) ratings as defined in IES TM-15-11; and
 3. Allowable BUG ratings not exceeding those shown in Table 5.106.8, or
 4. Comply with a local ordinance lawfully enacted pursuant to Section 101.7, whichever is more stringent.
 5. Exceptions:
 - a. Luminaires that qualify as exceptions in Section 147 of the California Energy Code.
 - b. Emergency lighting.
 - c. Building façade meeting the requirements in Table 140.7-B of the California Energy Code, Part 6.
 - d. Custom lighting features as allowed by the local enforcing agency, as permitted by Section 101.8 Alternate materials, designs and methods of construction.
- G. Grading and Paving: Construction plans shall indicate how site grading or a drainage system will manage all surface water flows to keep water from entering buildings.

2.09 ENERGY EFFICIENCY

- A. Indoor Water Use: Separate submeters shall be installed for the uses described in Section 5.303.1.1 and 5.303.1.2.
- B. Water Conserving Plumbing Fixtures and Fittings: Plumbing fixtures (water closets and urinals) and fittings (faucets and showerheads) shall comply with the following:
1. The effective flush volume of all water closets shall not exceed 1.28 gallons per flush. Tank-type water closets shall be certified to the performance criteria of the U.S. EPA WaterSense Specification for Tank-Type Toilets.
 2. The effective flush volume of wall-mounted urinals shall not exceed 0.125 gallons per flush.
 3. The effective flush volume of all floor-mounted urinals shall not exceed 0.5 gallons per flush.
 4. Showerheads shall have a maximum flow rate of not more than 2.0 gallons per minute at 80 psi. Showerheads shall be certified to the performance criteria of the U.S. EPA WaterSense Specification for Showerheads.
 5. When a shower is served by more than one showerhead, the combined flow rate of all showerheads and/or other shower outlets controlled by a single valve shall not exceed 2.0 gallons per minute at 80 psi, or the shower shall be designed to allow only one shower outlet to be in operation at a time.
 - a. A hand-held shower shall be considered a showerhead.
 6. Lavatory faucets shall have a maximum flow rate of not more than 0.5 gallons per minute at 60 psi.
 7. Kitchen faucets shall have a maximum flow rate of not more than 1.8 gallons per minute at 60 psi. Kitchen faucets may temporarily increase the flow above the maximum rate, but not to exceed 2.2 gallons per minute at 60 psi, and must default to a maximum flow rate of 1.8 gallons per minute at 60 psi.
 8. Wash fountains shall have a maximum flow rate of not more than 1.8 gallons per minute/20 (rim space (inches) at 60 psi).

9. Metering faucets shall not deliver more than 0.20 gallons per cycle.
10. Metering faucets for wash fountains shall have a maximum flow rate of not more than 0.20 gallons per minute/20 (rim space (inches) at 60 psi).

- a. Where complying faucets are unavailable, aerators or other means may be used to achieve reduction.

11. Disposers shall either modulate the use of water to no more than 1 gpm when the disposer is not in use (not actively grinding food waste/no-load) or shall automatically shut off after no more than 10 minutes of inactivity. Disposers shall use no more than 8 gpm of water.
12. For those occupancies within the authority of California Building Standards Commission as specified in Section 103, the provisions of Section 5.303.3 shall apply to new fixtures in additions or areas of alteration to the building.
13. Plumbing fixtures and fittings shall be installed in accordance with the California Plumbing Code, and shall meet the applicable standards referenced in Table 1401.1 of the California Plumbing Code and in Chapter 6 of CALGreen.

C. Outdoor Water Use: Comply with Section 5.304 as follows:

1. Outdoor water use in landscape areas equal to or greater than 500 square feet shall comply with Section 5.304.2.
2. Outdoor water use in rehabilitated landscape projects equal to or greater than 2,500 square feet shall comply with Section 5.304.3.
3. Outdoor water use in landscape areas of 2,500 square feet or less shall comply with Section 5.304.4.
4. Graywater or rainwater use in landscape areas shall comply with Section 5.304.5.
5. Outdoor potable water use in landscape areas shall comply with Section 5.304.6.

PART 3 - EXECUTION

3.01 CONSTRUCTION WASTE MANAGEMENT

- A. Comply with Section 01 74 19 "Construction Waste Management and Disposal."

3.02 POLLUTANT CONTROL

- A. Temporary Ventilation per Section 5.504.1:

1. The permanent HVAC system shall only be used during construction if necessary to condition the building or areas of addition or alteration within the required temperature range for material and equipment installation. If the HVAC system is used during construction, use return air filters with a minimum efficiency reporting value (MERV) of 8, based on ASHRAE 52.2, or an average efficiency of 30 percent based on ASHRAE 52.1. Replace all filters immediately prior to occupancy, or, if the building is occupied during alteration, at the conclusion of construction.

- B. Covering of Duct Openings and Protection of Mechanical Equipment During Construction per Section 5.504.3.

1. At the time of rough installation and during storage on the construction site and until final startup of the heating, cooling and ventilating equipment, all duct and other related air

distribution component openings shall be covered with tape, plastic, sheetmetal, or other methods acceptable to the enforcing agency to reduce the amount of dust, water and debris which may enter the system.

- C. Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.

3.03 BUILDING MAINTENANCE AND OPERATION

- A. Recycling By Occupants: Per Section 5.410.1, provide readily accessible areas that serve the entire building and are identified for the depositing, storage and collection of non-hazardous materials for recycling, including (at a minimum) paper, corrugated cardboard, glass, plastics, organic waste, and metals or meet a lawfully enacted local recycling ordinance, if more restrictive.
 - 1. Additions: All additions conducted within a 12-month period under single or multiple permits, resulting in an increase of 30 percent or more in floor area, shall provide recycling areas on site.
 - a. Exceptions: Additions within a tenant space resulting in less than a 30-percent increase in the tenant space floor area.
 - 2. Sample Ordinance: Space allocation for recycling areas shall comply with Chapter 18, Part 3, Division 30 of the Public Resources Code. Chapter 18 is known as the California Solid Waste Reuse and Recycling Access Act of 1991 (ACT).
 - a. Note: A sample ordinance for use by local agencies may be found in Appendix A of the document at the CALRecycle's web site.
- B. Commissioning: For new buildings 10,000 square feet and over, building commissioning shall be included in the design and construction process of the Project to verify that the building systems and components meet the Owner's Project Requirements. Commissioning shall be performed in accordance with Section 5.410.2 by trained personnel with experience on projects of comparable size and complexity. All occupancies other than I-occupancies and L-occupancies shall comply with the California Energy Code as prescribed in California Energy Code Section 120.8.
 - 1. Refer to Section 01 91 13 "General Commissioning Requirements" for additional commissioning requirements.

END OF SECTION

SECTION 02 41 16

STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of buildings and site improvements.
2. Removing below-grade construction.
3. Disconnecting, capping or sealing, and abandoning in-place and removing site utilities.
4. Salvaging items for reuse by Owner.

B. Related Requirements:

1. Section 31 10 00 "Site Clearing" for site clearing and removal of above- and below-grade site improvements not part of building demolition.

1.2 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner. Include fasteners or brackets needed for reattachment elsewhere.

1.3 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be demolished.
2. Review structural load limitations of existing structures.
3. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review and finalize protection requirements.
5. Review procedures for noise control and dust control.
6. Review procedures for protection of adjacent buildings.

7. Review items to be salvaged and returned to Owner.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For refrigerant recovery technician.
- B. Engineering Survey: Submit engineering survey of condition of building.
- C. Schedule of Building Demolition Activities: Indicate the following:
 1. Detailed sequence of demolition work, with starting and ending dates for each activity.
 2. Temporary interruption of utility services.
 3. Shutoff and capping or re-routing of utility services.
- D. Predemolition Photographs or Video: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Submit before the Work begins.
- E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.6 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.

1.7 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

1.8 FIELD CONDITIONS

- A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- A. Hazardous Materials: Present in buildings and structures to be demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.
- B. On-site storage or sale of removed items or materials is not permitted.

1.9 COORDINATION

- A. Arrange demolition schedule so as not to interfere with Owner's on-site operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ASSE A10.6 and NFPA 241.
- C. Comply with California Fire Code (CFC), California Code of Regulations, (CCR) Title 24, Part 9, Chapter 14 - Fire Safety During Construction and Demolition.

2.2 SOIL MATERIALS

- A. Satisfactory Soils: Comply with requirements in Section 31 20 00 "Earth Moving."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.
- D. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

3.2 PREPARATION

- A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.
- B. Salvaged Items: Comply with the following:
 - 1. Clean salvaged items of dirt and demolition debris.
 - 2. Pack or crate items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until delivery to Owner.
 - 4. Transport items to storage area designated by Owner.
 - 5. Protect items from damage during transport and storage.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Utilities to be Disconnected: Locate, identify, disconnect, and seal or cap off utilities serving buildings and structures to be demolished.
 - 1. Arrange to shut off utilities with utility companies.
 - 2. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
 - 3. Cut off pipe or conduit a minimum of 24 inches below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.
 - 4. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.4 PROTECTION

- A. Existing Facilities: Protect adjacent walkways and other building facilities during demolition operations. Maintain exits from existing buildings.
- B. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.
 - 1. Strengthen or add new supports when required during progress of demolition.
- C. Existing Utilities to Remain: Maintain utility services to remain and protect from damage during demolition operations.
- D. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.5 DEMOLITION, GENERAL

- A. General: Demolish indicated buildings completely. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
 - 2. Maintain fire watch during and flame-cutting operations.
 - 3. Maintain fire safety during demolition in accordance with CFC, Chapter 14.
 - 4. Maintain adequate ventilation when using cutting torches.
 - 5. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
- B. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Explosives: Use of explosives is not permitted.

3.6 DEMOLITION BY MECHANICAL MEANS

- A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.
- B. Salvage: Items to be removed and salvaged are indicated on Drawings.
- C. Below-Grade Construction: Demolish foundation walls and other below-grade construction.
 - 1. Remove below-grade construction, including foundation walls, and footings, completely.
- D. Existing Utilities: Demolish and remove existing utilities and below-grade utility structures.

3.7 SITE RESTORATION

- A. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations with satisfactory soil materials according to backfill requirements in Section 312300 "Excavation and Fill."
- B. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.8 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Do not burn demolished materials.

3.9 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.
 - 1. Clean roadways of debris caused by debris transport.

END OF SECTION 024116

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

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 specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Footings.
 - 2. Slabs-on-grade.
 - 3. Concrete on metal deck.
- B. Related Sections include the following:
 - 1. Division 31 Section "Earth Moving" for drainage fill under slabs-on-grade.
 - 2. Division 32 Section "Concrete Paving" for concrete pavement and walks.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.
- B. Cast-in-Place Architecturally Visible Concrete: Formed concrete that is viewed on surfaces of completed structure or building and that requires special concrete materials, formwork, placement, or finishes to obtain specified architectural appearance.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
 - 2. Indicate and provide documentation for each type of add mixture.
 - 3. Indicate water-cement ratio and strength for each mixture.

- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Sustainable design requirements project submittal form, found in Appendix A of Section 01810 "Sustainable Design Requirements". Provide the following information for all cast-in-place concrete:
 - 1. Recycled content
 - 2. Regional materials (if applicable)

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician. Submit evidence of certification to Architect and District.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Testing Agency Qualifications: An independent agency, retained by the Owner and approved by the Division of State Architect, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
 - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
- E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specification for Structural Concrete,"
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- F. Pre-installation Conference: Conduct conference at Project site with Architect, Structural Engineer and Testing Agency to comply with requirements in Division 01 Section "Project Management and Coordination."

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete subcontractor.
 2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semi-rigid joint fillers, forms and form removal limitations, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, concrete repair procedures, and concrete protection.
- G. Mockups: before casting architecturally visible concrete, build mockups to verify selections made under sample submittals and to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship. Build mockups to comply with the following requirements, using materials indicated for the complete work:
1. Build mockups in the location and of the size indicated, if not indicated, as directed by Architect.
 2. Build mockups of typical exterior wall of cast-in-place architectural concrete as shown on drawings to show reveals, pop outs, joints, form ties, and any other architectural features. Contractor to provide shop drawings of proposed mockup for approval prior to constructing mockups.
 3. Demonstrate curing, cleaning, and protecting of cast-in-place architectural concrete, finishes, and contraction joints, as applicable.
 4. In presence of Architect, damage part of the exposed-face surface for each finish, color, and texture and demonstrate materials and techniques proposed for repair of tie holes, and surface blemishes to match adjacent undamaged surfaces.
 5. Obtain Architect/District approval of mockups before casting concrete. No concrete shall be placed beyond footings without approval by Architect/District.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Store reinforcing on dunnage
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
 - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1 or better.
 - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
 - c. Structural 1, B-B or better; mill oiled and edge sealed.
 - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.

3. Furnish ties with integral water-barrier plates to walls indicated to receive damp-proofing or waterproofing.

2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed. Unless otherwise indicated on drawings.
- B. Reinforcing Bars at Shear Wall Boundaries and Bars to be Welded: A 706, Grade 60, deformed.
- C. Plain-Steel Wire: ASTM A 82, as indicated.
- D. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets, 60ksi minimum.

2.4 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
- C. Reinforcing Bar Couplers: Provide Type II where indicated on plans. For couplers to be used as alternate to lap splices, submit proposed coupler and proposed location for review and approval by EOR and DSA.

2.5 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, as noted below for the following conditions:
 1. Portland Cement at Architecturally Visible Concrete: ASTM C 150, Type V gray.
 2. Portland Cement at all other conditions: ASTM C 150, Type as indicated on drawings.
 - a. Fly Ash: ASTM C 618, Class C or F, 100lbs. maximum per cubic yard, containing 1% or less carbon. Fly ash shall not be used in excess of 30% by weight of total cement quantity.
- B. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
 1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.

2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M and potable.

2.6 ADMIXTURES

A. Chemical (Water Reducing) Admixture: ASTM C494, Type A, D, or E. Only one brand. When used, are subject to approval of Owner's Representative, and must reduce the mixing water at least 10% without entraining air in excess of 2% by volume. If the water reducing agent entrains more than 2% air, the water reduction shall be at least 12 %, but in no case shall the water reducing agent entrain air in excess of 4%.

B. Air-entraining admix: ASTM C260.

C. Pozzolan: ASTM C618, Class F or C Fly Ash, 100 lbs. maximum per cubic yard, containing 1% or less carbon. Fly ash shall not be used in excess of 30% by weight of total cement quantity.

D. Super-Plasticizers (High Range Water Reducers): ASTM C494, Type F or G. Master Builders "Rheobuild", Euclid "Eucon 37" or equal, capable of producing concrete which can be placed at 8-11" slump without segregation, capable of maintaining slump within 2" of that initially mixed for 2 hours, and of maintaining concrete temperature within 2° F. from time of batching for 2 hours minimum.

2.7 WATERSTOPS

A. Flexible Rubber Waterstops (where indicated on drawings): CE CRD-C 513 for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

1. Manufacturers:

- a. Greenstreak.
- b. Progress Unlimited, Inc.
- c. Williams Products, Inc.
- d. Tremco Parastop II
- e. Henry HF 302 Hydro-Flex Watertop
- f. Cetco Waterstop-RX
- g. Or approved equal

2.8 VAPOR RETARDERS

A. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

B. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch sieve, 10 to 30 percent passing a No. 100 sieve, and at least 5 percent passing

No. 200 sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

- C. Plastic Vapor Retarder: ASTM E 1745, Class B. Include manufacturer's recommended adhesive or pressure-sensitive tape.

- 1. Stego Wrap; thickness as indicated on drawings, 10 mils minimum.

2.9 CURING MATERIALS

- A. Curing and Sealing Compound: Curing and sealing compound shall be VOC compliant, comply with ASTM C309, compatible with flooring adhesives.

- 1. SpecChem E-Cure.
 - 2. Or approved equal.

- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

- D. Water: Potable.

2.10 RELATED MATERIALS

- A. Expansion and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

- C. Styrofoam: Expanded Polystyrene, Type X1, Density = 1pcf, Compressive strength 5psi @ 10% deformation.

2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings: Proportion normal-weight concrete mixture as follows:

- 1. Minimum Compressive Strength: 3,000 psi, or as indicated on drawings, at 28 days.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.50.
 - 3. Slump Limit: Maximum 4 inches.

- B. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

- 1. Minimum Compressive Strength: 4,000 psi, or as indicated on drawings, at 28 days.
 - 2. Minimum Cementitious Materials Content: 540 lb/cu. yd.
 - 3. Slump Limit: Maximum 4 inches.

4. Maximum Water-Cementitious Materials Ratio: 0.45 for concrete surfaces to receive adhered flooring – 0.50 (elsewhere)

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 1. Refer to Architectural drawings for locations of finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 1. Install keyways, reglets, recesses, and the like, for easy removal.
 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete as directed by Architect.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.
- M. Provide metal (smooth) formwork for Architecturally Visible Concrete to attain desired finish as directed in mockup.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 75 percent of its 28-day design compressive strength.
 - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR RETARDERS

- A. Granular Course: Cover vapor retarder with granular fill or fine-graded granular material, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch.

3.5 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.6 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 - 2. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 3. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks. Do not cut reinforcing.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
 - 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
 - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 WATERSTOPS

- A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

3.8 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 4. Slope surfaces uniformly to drains where required.
 - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

- E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- F. Hot-Weather Placement: Comply with ACI 301 and ACI 305R and as follows:
 - 1. During hot weather, proper attention shall be provided for ingredients, production methods, handling, placing, protection and curing, to prevent excessive concrete temperatures or water evaporation which could impair required strength or durability.
 - 2. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.9 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces exposed to public view (Architecturally Visible Concrete).
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.10 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture

- 1. Apply float finish to surfaces indicated on drawings.

- C. Broom Finish: Exterior stair treads and landings shall be provided with a non-slip broom finish in addition to abrasive finish specified.

- D. Abrasive Stair Nosing: Nosing shall be tooled per drawings.

3.11 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

3.12 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305R for hot-weather protection during curing.

- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods (submit procedure as part of submittal process):

- 1. Moisture Curing (Preferred District Method): Keep surfaces continuously moist for not less than seven days with the following materials:

- a. Water.

- b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
- 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
- 3. Curing Compound: 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.
 - a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.
- 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a 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. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.13 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions where indicated on drawings.
 - 1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semi-rigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - 2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 - 1. Repair finished surfaces containing defects. Surface defects include spalls, pop-outs, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 - 2. After concrete has cured at least 14 days, correct high areas by grinding.
 - 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 - 4. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 - 5. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
 - F. Repair materials and installation not specified above may be used, subject to Architect's approval.
- 3.15 FIELD QUALITY CONTROL
- A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
 - B. Inspections:
 - 1. Steel reinforcement placement.
 - 2. Headed bolts and studs.
 - 3. Verification of use of required design mixture.
 - 4. Concrete placement, including conveying and depositing.
 - 5. Curing procedures and maintenance of curing temperature.
 - 6. As indicated on DSA Form 103.
 - C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain at least one composite sample for each 50 cu. yd. or fraction thereof of each concrete mixture placed each day, plus not less than one for each 2,000 square feet of slabs or walls.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 - 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173/C 173M, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - 4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
 - 5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - 6. Compression Test Specimens: ASTM C 31/C 31M.

- a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
 - a. If 28-day compressive-strength test falls below satisfactory levels, strength test the spare cylinder at age determined by the Contractor and average with the strength of the 28-day specimens. The average strength of the three cylinders shall be considered one compressive-strength test.
10. Test results shall be reported in writing to Architect, concrete manufacturer, Project Inspector, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
 - a. Concrete with inadequate slumps, air entrainment, etc. shall not be placed. Costs associated with additional testing will be incurred by Contractor.
13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
15. Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.

END OF SECTION

SECTION 04 22 00

CONCRETE UNIT MASONRY

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Mortar and grout.
3. Steel reinforcing bars.
4. Miscellaneous masonry accessories.

B. Related Sections:

1. Division 07 Section "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
 1. Concrete Masonry Unit Test: For each type of unit required, according to ASTM C 140 for compressive strength.
 2. Mortar Test (Property Specification): For each mix required, according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
 3. Mortar Test (Property Specification): For each mix required, according to ASTM C 780 for compressive strength.
 4. Grout Test (Compressive Strength): For each mix required, according to ASTM C 1019.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
- C. Shop Drawings: For the following:
 - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 - 2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Material Certificates: For each type and size of the following:
 - 1. Masonry units.
 - a. Include material test reports substantiating compliance with requirements.
 - 2. Cementitious materials. Include brand, type, and name of manufacturer.
 - 3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 - 4. Grout mixes. Include description of type and proportions of ingredients.
 - 5. Reinforcing bars.
- C. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
 - 1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
 - 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- D. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.7 QUALITY ASSURANCE

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- C. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Always retain first paragraph below in case Contractor uses a preblended, dry mortar mix.
- E. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.
- F. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.9 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.

4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40° F and higher and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

2.2 CONCRETE MASONRY UNITS

- A. Regional Materials: CMUs shall be manufactured within 500 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- B. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 2. Provide square-edged units for outside corners unless otherwise indicated.
- C. Concrete Unit Masonry: Conforming to ASTM C90, Grade N-1, hollow load-bearing concrete unit masonry.
 1. Density Classification: Medium weight unless otherwise indicated.
 2. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
 3. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.

2.3 MORTAR AND GROUT MATERIALS

- A. Regional Materials: Aggregate for mortar and grout, cement, and lime shall be extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- B. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- C. Hydrated Lime: ASTM C 207, Type S.

- D. Portland Cement-Lime Mix: Packaged blend of Portland cement and hydrated lime containing no other ingredients.
- E. Aggregate for Mortar: ASTM C 144.
- F. Aggregate for Grout: ASTM C 404.
- G. Water: Potable.

2.4 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M, Grade 60, or ASTM A 706/A 706M.

2.5 MISCELLANEOUS ANCHORS

- A. Anchor Bolts: Headed steel bolts complying with ASTM F 1544, Grade 36; with ASTM A 563, Grade A hex nuts and; ASTM F 436 flat washers, UNO drawings.

2.6 MISCELLANEOUS MASONRY ACCESSORIES

- A. Preformed Control-Joint Gaskets: Made from PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- B. Elastomeric Sealant: ASTM C 920, chemically curing polysulfide sealant; of type, grade, class, and use classifications required to seal joints and remain watertight.
- C. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

2.7 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Use portland cement-lime mortar unless otherwise indicated.
 - 3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification for Type S.
- D. Grout for Unit Masonry: Comply with ASTM C 476.
 - 1. Use grout that will comply with Table 1.16.1 in ACI 530/ASCE 5/TMS 402 for dimensions of grout spaces and pour height.
 - 2. Proportion grout in accordance with ASTM C 476, paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.

3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 2. Verify that foundations are within tolerances specified.
 3. Verify that reinforcing dowels are properly placed.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Build chases and recesses to accommodate items specified in this and other Sections.
- B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.3 TOLERANCES

- A. Dimensions and Locations of Elements:
 1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
 2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.
- B. Lines and Levels:
 1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.

3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar before laying fresh masonry.
- D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- F. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
 1. Install compressible filler in joint between top of partition and underside of structure above.
 2. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Division 07 Section "Fire-Resistive Joint Systems."

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
 - 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 - 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 - 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
- B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- C. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.6 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry as follows:
 - 1. Install preformed control-joint gaskets designed to fit standard sash block.
 - 2. Keep head joints free and clear of mortar or rake out joint for application of sealant.

3.7 FLASHING

- A. General: Install embedded flashing in masonry at lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
- B. Install flashing as follows unless otherwise indicated:
 - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 - 2. At lintels, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
 - 3. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Division 07 Section "Joint Sealants" for application indicated.
 - 4. Install metal drip edges with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Division 07 Section "Joint Sealants" for application indicated.
 - 5. Retain one of three subparagraphs below if flexible flashing materials are used. See Evaluations.

6. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal drip edge.
- C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

3.8 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 2. Limit height of vertical grout pours to not more than 60 inches.

3.9 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.
- B. Inspections: Level 1 special inspections according to the "California Building Code."
 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
- D. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.
- E. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

3.10 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.11 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Excess Masonry Waste: Remove excess clean masonry waste and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

SECTION 05 12 00

STRUCTURAL STEEL FRAMING

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. Structural steel.
 - 2. Grout.
- B. Related Sections include the following:
 - 1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
 - 2. Division 05 Section "Steel Decking" for field installation of shear connectors.
 - 3. Division 05 Section "Metal Fabrications" for miscellaneous steel fabrications and other metal items not defined as structural steel.
 - 4. Division 01 Section "Sustainable Design Requirements"

1.3 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication of structural-steel components.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Include embedment drawings.
 - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
 - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pre-tensioned and slip-critical high-strength bolted connections.

- C. Weld Procedures: Submit weld procedures for connections other than rigid frames. Weld procedures shall be qualified as described in AWS D1.5, Section 5.12 or 5.13 for self shielded FCAW, Weld procedures shall indicate joints details and tolerances, preheat and interpass temperature, post-heat treatment, single or multiple stringer passes, peening of stringer passes for groove welds except for the first and the last pass, electrode type and size, welding current, polarity and amperes and root treatment. The welding variables for each stringer pass shall be recorded and averaged, from these averages the weld heat input shall be calculated.
- D. Welder's Certificates: Field welders shall be Project certified in accordance with AWS D1. 1-10. Shop welders shall be Project certified for FCAWS in accordance with AWS D1. 1-10.
- E. Qualification Data: For Installer and fabricator.
- F. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:
 - 1. Structural steel including chemical and physical properties.
 - 2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 3. Direct-tension indicators.
 - 4. Tension-control, high-strength bolt-nut-washer assemblies.
 - 5. Shear stud connectors.
 - 6. Shop primers.
 - 7. Non-shrink grout.
- G. Source quality-control test reports.
- H. Charpy-V-Notch (CVN) Impact Test: Submit certified copies of Charpy-V-Notch (CVN) Impact Test by the manufacturer for applicable steel members and components.
 - 1. Charpy-V-Notch (CVN) Impact Test for Base Metal: Moment frame columns, girders and other structural steel which is to be complete joint penetration welded and subjected to Charpy-V-Notch impact test in accordance with ASTM E 23 and ASTM A 673.

Exception: Rolled shapes listed under Groups 4 and 5 of the 14th edition of the AISC Manual of Steel Construction shall have the Charpy-V-Notch test, as specified above, performed on flange material at the juncture of the web and flange, shown in AISC Manual.
 - 2. Charpy-V-Notch test shall be performed by the manufacturer employing Test Frequency (P) in accordance with ASTM A 673 and utilizing standard specimen sizes shown in Figure 6 of ASTM E 23. The absorbed energy in a CVN impact test shall not be less than that specified in Material Part 2 of this section.
 - 3. Sustainable Design Requirements submittal form, found in Appendix A of Section 0810 "Sustainable Design Requirements". Provide the following for all structural steel framing:

- a. Recycled content
- b. Regional materials (if applicable)

1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."
- B. Comply with applicable provisions of the following current specifications and documents:
 - 1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 - 2. AISC's "Seismic Provisions for Structural Steel Buildings" and "Supplement No. 2."
 - 3. AISC's "Load and Resistance Factor Design Specification for Structural Steel Buildings."
 - 4. AISC's "Specification for Load and Resistance Factor Design of Single-Angle Members."
 - 5. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - 6. AWS D1.8 "Structural Welding Code – Seismic Supplement".
- C. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.
 - 1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
 - 2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Provide and install 10 tons of structural steel in addition to quantities shown on the drawings at no additional cost to Owner. This additional steel shall be installed during construction, in sizes and locations as directed.

1.7 COORDINATION

- A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992, ASTM A 572, Grade 50.
- B. Channels, Angles, M, S-Shapes: ASTM A 36 Grade 36.
- C. Plate and Bar: ASTM A 36, Grade 36, U.N.O.
- D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing, 46 ksi.
- E. Steel Pipe: ASTM A 53, Type E or S, Grade B, 35 ksi.
 - 1. Finish: Primer and galvanized where indicated.
- F. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers, plain.
 - 1. Finish: Plain.
 - 2. Direct-Tension Indicators: ASTM F 959, Type 325 compressible-washer type.
 - a. Finish: Plain.
- B. High-Strength Bolts, Nuts, and Washers: ASTM A 490, Type 1, heavy hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers, plain.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 490, compressible-washer type, plain.
- C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy hex head steel structural bolts with splined ends; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
 - 1. Finish: Plain.
- D. Shear Connectors: ASTM A29, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.
- E. Headed Anchor Rods: ASTM A 307, Grade A, unless specified otherwise on drawings.
 - 1. Nuts: ASTM A 563 hex carbon steel.
 - 2. Plate Washers: ASTM A 36 carbon steel.
 - 3. Washers: ASTM F 436 hardened carbon steel.
 - 4. Finish: Plain.

- F. Threaded Rods: ASTM A 36.
 - 1. Nuts: ASTM A 563 hex carbon steel.
 - 2. Washers: ASTM F 436 hardened carbon steel.
 - 3. Finish: Plain.
- 2.3 PRIMER
 - A. Primer: SSPC-Paint 25, Type II, iron oxide, zinc oxide, raw linseed oil, and alkyd.
- 2.4 GROUT
 - A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, non-metallic aggregate grout, non-corrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.
- 2.5 FABRICATION
 - A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Load and Resistance Factor Design Specification for Structural Steel Buildings:"
 - 1. Camber structural-steel members where indicated.
 - 2. Identify high-strength structural steel according to ASTM A 6/ A 6M and maintain markings until structural steel has been erected.
 - 3. Mark and match-mark materials for field assembly.
 - 4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
 - B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
 - C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.
 - D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
 - E. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.
 - F. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.

2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 1. Joint Type: Snug tightened, pre-tensioned or slip critical as indicated.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
 1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

2.7 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
 2. Surfaces to be field welded.
 3. Surfaces to be high-strength bolted with slip-critical connections.
 4. Surfaces to receive sprayed fire-resistive materials.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 1. SSPC-SP 2, "Hand Tool Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 1. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

2.8 SOURCE QUALITY CONTROL

- A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- C. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:
 1. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 2. Ultrasonic Inspection: ASTM E 164.
 3. Radiographic Inspection: ASTM E 94.
- E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:
 1. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.
 1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Load and Resistance Factor Design Specification for Structural Steel Buildings."
 - B. Base and Bearing Plates: Clean concrete bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
 - 1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of base plate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
 - C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 - D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
 - E. Splice members only where indicated.
 - F. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
 - G. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.
- 3.4 FIELD CONNECTIONS
- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened.
 - B. Weld Connections: Comply with AWS D1.1 and D1.8 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Load and Resistance Factor Design Specification for Structural Steel Buildings" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
- B. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1 and D1.8.
 1. In addition to visual inspection, field welds will be tested according to AWS D1.1, D1.8 and the following inspection procedures, at testing agency's option:
 - a. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - b. Ultrasonic Inspection: ASTM E 164.
 - c. Radiographic Inspection: ASTM E 94.
- D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:
 1. Perform bend tests if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
 2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.
- E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

- A. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, bearing plates, and abutting structural steel. Applicable to galvanized connections.
 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
- B. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.

END OF SECTION

SECTION 05 30 00

METAL DECKING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Steel roof deck with accessories.
 - 2. Bent plate and sheet metal closures at decking edges and openings.
 - 3. Holes through decking, with reinforcing.
- B. Related Work Specified Elsewhere:
 - 1. Hoisting of decking.
 - 2. Structural steel framing and supports for steel decking.

1.2 SUBMITTALS

- A. Shop Drawings: Submit fully detailing and dimensioning all steel decking including accessories, fastenings, welding, holes with reinforcing, flashings, and closures. Indicate welding according to AWS Standard Welding Symbols. Show dimensioned layouts for openings and reinforcing details.
- B. Calculations and Data: If steel decking of type differing from that indicated or specified is proposed, submit the manufacturer's calculations and supporting data showing that proposed decking conforms to requirements indicated and specified. Include the decking manufacturer's technical product data and copies of code approvals for proposed decking. Submit with shop drawings and obtain approval prior to fabrication and delivery of decking.

1.3 QUALITY ASSURANCE

- A. Qualifications of Welders: Employ welding operators currently tested and certified in accordance with code.
- B. Requirements of Regulatory Agencies: Provide steel floor and roof deck system that, with concrete fill, meets UL and code requirements for 2-hour fire-rated deck system.
- C. Source Quality Control: Furnish the decking manufacturer's certified mill analyses and test reports covering all decking.

PART 2 - PRODUCTS

2.1 DECKING MATERIALS

- A. Furnish metal roof decking fabricated of steel conforming to ASTM A653, Grade 33 (minimum), minimum yield strength of 38,000 psi.; galvanized per ASTM A653, G60 unless otherwise noted on drawings.
- B. Roof Decking: Type and manufacture noted on the drawings, lengths to span over at least 3 supports unless otherwise shown, each panel factory slotted or having rolled-in moisture venting provisions.
- C. Decking Accessories: Provide indicated and required decking accessories including, without limitation, welding washers and welding anchors, closures, transitions, and filler strips, as required for complete installations. Provide bent plate closures, angles, channels, and attachments as required for openings through decking for ducts, shafts, piping, and other penetrations; where decking changes direction; and at decking perimeter; fabricated of 16 gage galvanized steel unless otherwise shown. Provide roof drain and overflow sumps of minimum 14 gage galvanized steel.
- D. Galvanizing Repair Paint: Zinc rich paint conforming to Mil Spec MIL-P-21035 (SHIPS).
- E. Welded Shear Stud Connectors: As specified in Section 051200.

PART 3 - EXECUTION

3.1 INSTALLATION OF DECKING: Verify dimensions and actual site conditions to ensure proper fit and installation.

- A. Placing: Place steel decking on supports with full bearings, end joints centered over supports, and adjust to correct final position before completing permanent attachments. Place units in straight alignment for the entire length of run of flutes with close registration of flutes and with maximum 1/8" gap between ends of units, minimum 2" bearing on the supports. Do not splice units except at supports. Conform to code approvals and approved submittals.
- B. Cutting and Fitting: Perform cutting and fitting at columns, perimeters, shafts, stairs, and other openings. Provide tight fitting closures at the open uncovered ends and edges of decking, and all miscellaneous supports required to carry the metal decking. Secure hole reinforcement to decking with fillet welds placed on both sides of reinforcing members. Place reinforcement channels and angles across flutes and to project a distance beyond sides of openings equal to the maximum size of the opening unless otherwise shown. Perform field cutting and trimming square and neat, equal to factory cutting. Decking shall run through all openings/penetrations besides piping sleeves smaller than 12" diameter through deck. Decking shall not be cut until contractor is ready to install penetrating parts.
- C. Welding: Use materials and methods in accordance with recommendations of metal decking manufacturer and approved submittals. Conform to AWS D1.1 and D1.3 and to the patterns and weld types shown, finished welds free of sharp points or edges. Field coat all welds and abraded surfaces upon completion with repair material. Omit the field coating where welds or abrasions are covered by concrete fill or sprayed fireproofing.
- D. Damaged Decking: Remove and replace all metal decking showing denting or other damage that adversely affects decking strength or subsequent materials, as directed.

3.2 CLEANING AND TOUCH-UP

- A. Remove surplus materials. Clean and touch-up raw edges of decking cut for openings with anodic galvanizing repair paint. Leave decks ready to receive subsequent materials.

3.3 FIELD QUALITY CONTROL

- A. Install all metal decking under continuous inspection, welding approved by Inspector before being covered. Conform welder qualifications and welding inspection to Code.

END OF SECTION

SECTION 05 40 00

COLD-FORMED METAL FRAMING

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. Exterior non-load-bearing wall framing.
 - 2. Ceiling joist framing.
- B. Related Sections include the following:
 - 1. Division 05 Section "Metal Fabrications" for masonry shelf angles and connections.
 - 2. Division 09 Section "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.
 - 3. Division 09 Section "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies.

1.3 SUBMITTALS

- A. Product Data: For each type of cold-formed metal framing product and accessory indicated.
- B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work. Include veneer support angle attachment locations and to ensure coordination with this installation. Show locations of expansion and seismic joints.
- C. Welding certificates.
- D. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:
 - 1. Steel sheet.
 - 2. Expansion anchors.
 - 3. Power-actuated anchors.
 - 4. Mechanical fasteners.

- 5. Horizontal drift deflection clips
 - 6. Miscellaneous structural clips and accessories.
 - E. Research/Evaluation Reports: For cold-formed metal framing.
- 1.4 QUALITY ASSURANCE
- A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated.
 - B. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
 - C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."
 - D. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - E. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."
 - F. Comply with AISI's "Standard for Cold-Formed Steel Framing" AISI S100 (2007) and Supplement.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
 - B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:
 - 1. AllSteel Products, Inc.
 - 2. Clark Steel Framing.
 - 3. Dietrich Metal Framing; a Worthington Industries Company.
 - 4. Innovative Steel Systems.
 - 5. Steel Construction Systems.
 - 6. United Metal Products, Inc.

2.2 MATERIALS

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 - 1. Grade: Grade 50, U.N.O. on plans.
 - 2. Coating: G60.
- B. Steel Sheet for Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
 - 1. Grade: Grade 50, U.N.O. on plans.
 - 2. Coating: G90.

2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: As noted on plans.
 - 2. Flange Width: As noted on plans.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: As noted on plans.
 - 2. Flange Width: As noted on plans.
- C. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
 - 1. Manufacturers: Subject to compliance with requirements, provide products in compliance with SSMA:
 - 2. Minimum Base-Metal Thickness: As noted on plans.
 - 3. Flange Width: As noted on plans.
- D. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure.

2.4 CEILING JOIST FRAMING

- A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: As noted on plans.
 - 2. Flange Width: As noted on plans.

2.5 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
 - 1. Bracing, bridging, and solid blocking.
 - 2. Anchor clips.
 - 3. End clips.
 - 4. Foundation clips.
 - 5. Backer plates.

2.6 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. Anchor Bolts: ASTM F 1554, Grade 36 (U.N.O. on plans), threaded carbon-steel hex-headed bolts, and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
- D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.
- E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

2.7 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: [SSPC-Paint 20 or DOD-P-21035] [ASTM A 780].
- B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.
- C. Shims: Load bearing, high-density multimonomer plastic, nonleaching.

- D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.8 FABRICATION

- A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
 - 4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials. All post application patch work to be performed per manufacture specifications and by approved applicator meeting manufacture requirements.

- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.
- C. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.
- D. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
- D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

- H. Install insulation, specified in Division 07 Section "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
- J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: 16 inches or as indicated.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Install single-leg deflection tracks and anchor to building structure.
 - 2. Connect drift clips to cold formed metal framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced in rows indicated on drawings but not more than 48 inches apart. Fasten at each stud intersection.
 - 1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - a. Install solid blocking at centers indicated.
 - 2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 - 3. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - 4. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.5 JOIST INSTALLATION

- A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.
- B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
 - 1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches.
 - 2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.
- C. Space joists not more than 2 inches from abutting walls, and as follows:
 - 1. Joist Spacing: 16 inches or as indicated.
- D. Frame openings with built-up joist headers consisting of joist and joist track, nesting joists, or another combination of connected joists if indicated.
- E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated.
- F. Install bridging at intervals indicated. Fasten bridging at each joist intersection as follows:
 - 1. Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
 - 2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.
- G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.
- H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.6 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel framing and supports for countertops.
2. Steel tube reinforcement for low partitions.
3. Steel framing and supports for mechanical and electrical equipment.
4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
5. Equipment screens.
6. Metal ladders.
7. Metal floor plate and fasteners.
8. Miscellaneous steel trim.
9. Metal bollards.
10. Loose bearing and leveling plates.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Paint products.
2. Grout.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

C. Delegated-Design Submittal: For ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- ###### A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design metal fabrications.

- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- C. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- D. Rolled-Stainless-Steel Floor Plate: ASTM A 793.
- E. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- F. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.
- G. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
- H. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.
- I. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.
- J. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- K. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.
- L. Nickel Silver Castings: ASTM B 584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
- B. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors, as indicated.
 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593 and nuts, ASTM F 594.

2.4 MISCELLANEOUS MATERIALS

- A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- B. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- F. Concrete: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 4500 psi.

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.
- C. Weld corners and seams continuously to comply with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended.
- D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Locate joints where least conspicuous.
- E. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- F. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors not less than 8 inches from ends and corners of units and 24 inches o.c.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

2.7 METAL LADDERS

- A. General:
 - 1. Comply with ANSI A14.3.
- B. Steel Ladders:
 - 1. Siderails: As indicated.
 - 2. Rungs: As indicated.
 - 3. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
 - 4. Provide nonslip surfaces on top of each rung.
 - 5. Galvanize exterior ladders, including brackets.

2.8 METAL FLOOR PLATE

- A. Fabricate from rolled-steel floor of thickness indicated on Drawings.
 - 1. Pattern: Checkered as indicated.
 - 2. Provide reducer shapes of same material, pattern and finish to meet adjacent finish flooring flush.
- B. Provide attachment as indicated.

2.9 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
- C. Galvanize exterior miscellaneous steel trim.
- D. Prime exterior miscellaneous steel trim with zinc-rich primer, unless otherwise indicated.

2.10 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 40 steel pipe.
- B. Prime bollards with zinc-rich primer.

2.11 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

2.12 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.
- B. Galvanize loose steel lintels located in exterior walls.
- C. Prime loose steel lintels located in exterior walls with zinc-rich primer, unless otherwise indicated.

2.13 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.14 FINISHES, GENERAL

- A. Finish metal fabrications after assembly.

2.15 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
- B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
- C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
 - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 3. Items Indicated to Receive Primers Specified in Section 09 96 00 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 4. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLING METAL BOLLARDS

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
- B. Anchor bollards in concrete. Fill annular space around bollard solidly with nonshrink grout.
- C. Fill bollards solidly with concrete, mounding top surface to shed water.

3.3 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 055000

SECTION 05 52 13

PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel pipe and tube railings.

B. Related Sections:

1. Section 09 22 16 "Non-Structural Metal Framing" for metal backing for anchoring railings.

1.2 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected railings.
2. Railing brackets.
3. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
2. Fittings and brackets.

A. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified professional engineer.
- B. Welding certificates.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of railing from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. applied in any direction, but not less than subparagraph b.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.

- b. Infill load and other loads need not be assumed to act concurrently.
- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.3 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
 - 1. Provide type of bracket that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.4 STEEL AND IRON

- A. Tubing: ASTM A 500 (cold formed); $F_y = 42$ ksi (round) and $F_y = 46$ ksi (rectangular).
- B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads. $F_y = 35$ ksi.
 - 1. Provide galvanized finish for exterior installations and where indicated.
- C. Plates, Shapes, and Bars: ASTM A 36/A 36M.
- D. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.5 FASTENERS

- A. General: Provide the following:
 - 1. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Fasteners for Interconnecting Railing Components:
 - 1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.

2.6 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Shop Primers: Provide primers that comply with Section 099600 "High-Performance Coatings."
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- G. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 - 1. Water-Resistant Product: At exterior locations provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.7 FABRICATION

- A. Railings and handrails: CBC Section 11B-505.
 - 1. Top of gripping surfaces of handrails shall be 34 inches minimum and 38 inches maximum vertically above walking surfaces, stair nosings, and ramp surfaces. Handrails shall be at a consistent height above such surfaces.
 - 2. Clearance between handrail gripping surfaces and adjacent surfaces shall be 1-1/2 inches minimum. Handrail may be located in a recess if the recess is 3 inches maximum deep and 18 inches minimum clear above the top of the handrail.
 - 3. Handrail gripping surfaces shall be continuous along their length and shall not be obstructed along their tops or sides. The bottoms of handrail gripping surfaces shall not be obstructed for more than 20 percent of their length. Where provided, horizontal projections shall occur 1-1/2 inches minimum below the bottom of the handrail gripping surfaces.
 - 4. Handrail gripping surfaces with a circular cross section shall have an outside diameter of 1-1/4 inches minimum and 2 inches maximum.
 - 5. Handrail gripping surfaces with non-circular cross section shall have an outside dimension of 4 inches minimum and 6-1/4 inches maximum, and a cross-sectional dimension of 2-1/4 inches maximum.
 - 6. Handrail gripping surfaces and any surfaces adjacent to them shall be free of sharp or abrasive elements and shall have rounded edges.
 - 7. Handrails shall not rotate within their fittings.
 - 8. Handrail gripping surfaces shall extend beyond and in the same direction of stair flights and ramp runs in accordance with CBC Section 11B-505.10. Such extensions are not required for continuous handrails at the inside turn of switchback or dogleg stairs and ramps.

9. A 2-inch minimum high curb or a barrier shall be provided to prevent the passage of a 4-inch diameter sphere rolling off the sides of a ramp surface. Such a curb or a barrier shall be continuous and uninterrupted along the length of a ramp. CBC Section 11B-405.9.2.
- B. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- C. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- D. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- E. Form work true to line and level with accurate angles and surfaces.
- F. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- G. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- H. Connections: Fabricate railings with welded connections unless otherwise indicated.
- I. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 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 flux immediately.
 4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- J. Form changes in direction as follows:
 1. By bending.
- K. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- L. Close exposed ends of railing members with prefabricated end fittings.
- M. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
- N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

- O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- P. For railing posts set in concrete, provide steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.
- Q. For removable railing posts, fabricate slip-fit sockets from steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.
 - 1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.
- R. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.8 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.9 STEEL AND IRON FINISHES

- A. Galvanized Railings:
 - 1. Hot-dip galvanize exterior steel and iron railings, including hardware, after fabrication.
 - 2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
 - 3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
 - 4. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
 - 5. Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
- D. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

1. Shop prime railings with primers specified in Section 099600 "High-Performance Coatings" are indicated.
- E. High-Performance Coating: Apply epoxy intermediate and polyurethane topcoats to prime-coated surfaces as indicated in Section 099600 "High-Performance Coatings." Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.
1. Color: Match Architect's sample.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners, as indicated, where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

- A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.
- B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.4 ANCHORING POSTS

- A. Use metal sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material.
- C. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
 - 1. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.
- D. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.5 ATTACHING RAILINGS

- A. Secure wall brackets and railing end flanges to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion anchors, as indicated, and/or hangers.
 - 2. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.

3.6 ADJUSTING AND CLEANING

- A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099600 "High-Performance Coatings."
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.7 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION 055213

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Included: Provide and install wood framing, sheathing, furring and other rough carpentry as indicated on the Drawings, specified herein, and as needed for a complete and proper installation.
- B. Related Work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to the County's administrative requirements.
 - 2. Section 06 20 00: Finish Carpentry.
 - 3. Section 06 41 16: Architectural Woodwork.

1.2 REFERENCES

- A. ASME B18.2.1 - Square and Hex Bolts and Screws.
- B. APA (The Engineered Wood Association) - Engineered Wood Construction Guide.
- C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
- D. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- E. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.
- F. AWWA C2 - Lumber, Timbers, Bridge Ties and Mine Ties-Preservative Treatment by Pressure Processes.
- G. AWWA C31 - Lumber Used Out Of Contact with the Ground and Continuously Protected from Liquid Water-Treatment by Pressure Processes.
- H. C.B.C. (California Building Code) 2013 Edition.
- I. FS UU-B-790 - Building Paper, Vegetable Fiber: (Kraft, Waterproofed, Water Repellent, and Fire Resistant).
- J. Redwood Inspection Service - Standard Specifications for Grades of California Redwood Lumber.
- K. WCLIB - West Coast Lumber Inspection Bureau.
- L. WWPA (Western Wood Products Association) - Western Lumber Product Use Manual.

1.3 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Codes and Standards: In addition to complying with pertinent codes and regulations of governmental agencies having jurisdiction, unless otherwise specifically directed or permitted by the Architect comply with the following.
 - 1. "Western Lumber Product Use Manual" of the WWPA for selection and use of products included in that manual.
 - 2. "Engineered Wood Construction Guide" of the APA.
 - 3. "Standard Specifications for Grades of California Redwood Lumber" of the Redwood Inspection Service, when Redwood is used.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of the County's administrative requirements.
- B. Protection: Carefully pile lumber off the ground. Cover all materials and protect from weather.

PART 2 - PRODUCTS

2.1 GRADE STAMPS

- A. Identify framing lumber by the grade stamp of the WCLIB, or such other grade stamp as is approved in advance by the Architect.
- B. Identify plywood as to species, grade, and glue type by the stamp of the APA.

2.2 MATERIALS

- A. Provide materials in the quantities needed for the Work shown on the Drawings, and meeting or exceeding the following standards of quality:
 - 1. Minimum Lumber Grades (with structural grades noted on Structural Drawings):

a.	2 x 4 Studs	Douglas Fir stud grade
b.	2 x 4 Studs in walls taller than or equal to 12'-0"	Douglas Fir #2
c.	2 x 4 and deeper	Douglas Fir #2
d.	4 x in non-load bearing walls	Douglas Fir #2
e.	All other 4 x Beams	Douglas Fir #1
f.	4 x Posts	Douglas Fir #2
g.	All 6 x and larger	Douglas Fir #1
h.	All furring	Douglas Fir construction grade

2. All Sill Plates Bearing on Concrete or Masonry: Pressure treated Douglas Fir.
3. Plywood: Standard sheathing with exterior glue. PS 1-95 with factory grading mark, as noted on Drawings.
4. Wood Preservative:
 - a. Preservative chemicals acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 - b. No materials to contain added urea-formaldehyde.
 - c. Preservative Treatment by Pressure Process: AWP A U1, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWP A C31 with inorganic boron (SBX).
5. Rough Hardware:
 - a. Steel Items:
 - 1) Comply with ASTM A36.
 - 2) Use galvanized at exterior locations.
 - b. Machine Bolts: Comply with ASTM A307.
 - c. Lag Bolts: Comply with ASME B18.2.1.
 - d. Nails:
 - 1) Use common except as otherwise noted.
 - 2) Comply with ASTM F1667.
 - 3) Use galvanized at exterior locations.
6. Building Paper: Kraft paper complying with FS UU-B-790.

2.3 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.2 WORKMANSHIP

- A. Carefully lay out, fit, and erect all framing plumb and level.

- B. Produce joints which are tight, true, and well nailed, with members assembled in accordance with the Drawings and with pertinent codes and regulations.

3.3 GENERAL FRAMING

A. General:

1. In addition to framing operations normal to the fabrication and erection indicated on the Drawings, install all wood blocking, backing, and framing required for the work of other trades.
2. Bearing studs may be notched to a depth not exceeding 1/4 its width but no closer than 5/8" to the edge of the stud.
3. Non-bearing studs may be notched to a depth not exceeding 40% of its width of bored to 60% of its width but not closer than 5/8" to the edge of the stud.

B. Bracing:

1. Brace all walls not solidly sheathed with 1 x 6 diagonal bracing at each end and at 25 feet on center per C.B.C.
2. Adequately brace structure as erection progresses.

3.4 BLOCKING

- A. Install blocking as required to support items of finish and to cut off concealed draft openings, both vertical and horizontal, between all ceiling and floor areas.
- B. Install solid blocking between joists at points of support and wherever sheathing is discontinuous. Blocking may be omitted where joists are supported on metal hangers.

3.5 ALIGNMENT

- A. On framing members to receive a finished surface, align the finish subsurface to vary not more than 1/8" from the plane of surfaces of adjacent furring and framing members.

3.6 INSTALLATION OF PLYWOOD SHEATHING

- A. Placement: Place plywood with face grain perpendicular to supports and continuously over at least two supports, except where otherwise shown on the Drawings.

3.7 FASTENING

A. Nailing:

1. Use only Common wire nails or spikes of the dimension shown on the Nailing Schedule, except where otherwise specifically noted on the Drawings.
2. Use untreated steel nails for interior work and concealed framing, and galvanized nails for all exposed exterior work.
3. Use nails long enough to penetrate at least one-half thickness of material.

4. Remove split members and replace with members complying with the specified requirements.
- B. Bolts and Screws:
1. Drill holes 1/16" larger in diameter than the bolts being used.
 2. Drill straight and true from one side only.
 3. For lag screws and wood screws, pre-bore holes same diameter as root of threads, enlarging holes to shank diameter for length of shank.
 4. Screw, do not drive, lag screws and wood screws.

3.8 NAILING SCHEDULE

- A. Unless otherwise directed by the Architect, comply with the nailing schedule and other fastening requirements contained in the pertinent regulations of governmental agencies having jurisdiction.

3.9 CLEANUP

- A. Broom clean inside and out, removing from the site all scraps and other debris left or caused by this work.

END OF SECTION

SECTION 06 20 23

FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior trim, including base and interior door frames.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.

1. Include data for wood-preservative treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained. Include chemical-treatment manufacturer's written instructions for finishing treated material.
2. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.
4. Include copies of warranties from chemical-treatment manufacturers for each type of treatment.

B. Samples for Verification:

1. For each species and cut of lumber and panel products with non-factory-applied finish, with 1/2 of exposed surface finished, 50 sq. in. for lumber and 8 by 10 inches for panels.
2. For each finish system and color of lumber and panel products with factory-applied finish, 50 sq. in. for lumber and 8 by 10 inches for panels.

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For fire-retardant-treated wood, from ICC-ES.

B. Sample Warranty: For manufacturer's warranty.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

- B. Installer Qualifications: Fabricator of products.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Protect materials from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.
- B. Deliver interior finish carpentry materials only when environmental conditions meet requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
 - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Composite Wood Products: Products shall be made without urea formaldehyde.
- B. Lumber: DOC PS 20 and the following grading rules:
 - 1. WCLIB: West Coast Lumber Inspection Bureau, Standard No. 17, "Grading Rules for West Coast Lumber."
 - 2. WWPA: Western Wood Products Association, "Western Lumber Grading Rules."
- C. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.
 - 1. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by inspection agency.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2.

1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 18 percent respectively.
2. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
3. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.
4. Do not use material that is warped or does not comply with requirements for untreated material.
5. Mark lumber with treatment-quality mark of an inspection agency approved by the American Lumber Standard Committee's Board of Review.
 - a. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
6. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
 - a. For exposed plywood indicated to receive a stained or natural finish, mark back of each piece.
7. Application: Where indicated.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: For applications indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction, and comply with testing requirements; testing by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent respectively.
- C. For exposed items indicated to receive a stained or natural finish, use organic resin chemical formulations that do not contain colorants, and provide materials that do not have marks from spacer sticks on exposed face.
- D. Do not use material that does not comply with requirements for untreated material or is warped or discolored.
- E. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
 2. For exposed plywood indicated to receive a stained or natural finish, mark back of each piece.

- F. Application: Where indicated.

2.4 INTERIOR TRIM

- A. Hardwood Lumber Trim for Transparent Finish (Stain or Clear Finish):

1. Species and Grade: As indicated on Drawings.
2. Face Surface: Surfaced (smooth).
3. Matching: Selected for compatible grain and color.

- B. Interior Door Frames for Transparent Finish (Stain or Clear Finish):

1. Species and Grade: As indicated on Drawings.
2. Face Surface: Surfaced (smooth).
3. Matching: Selected for compatible grain and color.

2.5 MISCELLANEOUS MATERIALS

- A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

- B. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.

1. Adhesives shall have a VOC content of 30 g/L or less.

- C. Multipurpose Construction Adhesive: Formulation complying with ASTM D 3498 that is recommended for indicated use by adhesive manufacturer.

1. Adhesives shall have a VOC content of 70 g/L or less.

2.6 FABRICATION

- A. Back out or kerf backs of the following members except those with ends exposed in finished work:

1. Interior standing and running trim except shoe and crown molds.

- B. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

- B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.

3.3 INSTALLATION, GENERAL

- A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, too small to fabricate with proper jointing arrangements, or with defective surfaces, sizes, or patterns.
- B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
 - 1. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
 - 2. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
 - 3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
 - 4. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

3.4 STANDING AND RUNNING TRIM INSTALLATION

- A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary. Stagger joints in adjacent and related standing and running trim. Cope at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.
 - 1. Match color and grain pattern of trim for transparent finish (stain or clear finish) across joints.
 - 2. Install trim after gypsum-board joint finishing operations are completed.
 - 3. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.

3.5 ADJUSTING

- A. Replace interior finish carpentry that is damaged or does not comply with requirements. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.6 CLEANING

- A. Clean interior finish carpentry on exposed and semi-exposed surfaces. Restore damaged or soiled areas and touch up factory-applied finishes, if any.

3.7 PROTECTION

- A. Protect installed products from damage from weather and other causes during construction.
- B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
 - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 062023

SECTION 06 41 16

PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-faced architectural cabinets including countertops and chair storage doors under stage.
2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.

1.2 PREINSTALLATION MEETINGS

- ###### A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- ###### A. Product Data: For each type of product, including high-pressure decorative laminate, adhesive for bonding plastic laminate and cabinet hardware and accessories.
- ###### B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
- ###### C. Samples:
1. Plastic laminates, for each color, pattern, and surface finish.
 2. Thermoset decorative panels, for each color, pattern, and surface finish.
 3. Exposed cabinet hardware and accessories, one unit for each type and finish.

1.4 INFORMATIONAL SUBMITTALS

- ###### A. Qualification Data: For fabricator.
- ###### B. Woodwork Quality Standard Compliance Certificates: WI Certified Compliance Program certificates.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Licensee of WI's Certified Compliance Program.
- B. Installer Qualifications: Fabricator of products.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.8 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.
 - 1. Provide labels and certificates from WI certification program indicating that woodwork, including installation, complies with requirements of grades specified.
- B. Grade: Custom.
- C. Type of Construction: Frameless.
- D. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.

- E. Reveal Dimension: As indicated.
- F. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
 - 1. Manufacturers: Subject to compliance with requirements, provide products indicated on Drawings or comparable products by one of the following:
 - a. Abet Laminati, Inc.
 - b. Formica Corporation.
 - c. Lamin-Art, Inc.
 - d. Nevmar Decorative Surfaces/Panolam Industries International, Inc.
 - e. Wilsonart International; Div. of Premark International, Inc.
- G. Laminate Cladding for Exposed Surfaces:
 - 1. Horizontal Surfaces: Grade HGS.
 - 2. Postformed Surfaces: Grade HGP.
 - 3. Vertical Surfaces: Grade HGS.
 - 4. Edges: Grade VGS.
 - 5. Pattern Direction: As indicated.
- H. Materials for Semiexposed Surfaces:
 - 1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade CLS.
 - 2. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.
 - 3. Drawer Bottoms: Thermoset decorative panels.
 - 4. Door Interior Faces: Thermoset decorative panels.
- I. Edge Treatment of Countertops: Same as laminate cladding on horizontal surfaces.
- J. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. As indicated by laminate manufacturer's designations.

2.2 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
 - 1. Wood Moisture Content: 5 to 10 percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
 - 1. Medium-Density Fiberboard: ANSI A208.2, Grade 130. made with binder containing no urea formaldehyde.
 - 2. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.3 CABINET HARDWARE AND ACCESSORIES

- A. General: Operable parts for all accessible casework shall comply with CBC Section 11B-309.
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening.
- C. Back-Mounted Pulls: BHMA A156.9, B02011.
- D. Wire Pulls: Back mounted, solid metal, dimensions as indicated on Drawings.
- E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04102; with shelf brackets, B04112.
- F. Shelf Rests: BHMA A156.9, B04013; metal, two-pin type with shelf hold-down clip.
- G. Drawer Slides: BHMA A156.9.
 - 1. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-overtravel-extension type; zinc-plated-steel ball-bearing slides.
 - 2. For drawers not more than 3 inches high and not more than 24 inches wide, provide Grade 1.
 - 3. For drawers more than 3 inches high but not more than 6 inches high and not more than 24 inches wide, provide Grade 1HD-100.
 - 4. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-200.
 - 5. For computer keyboard shelves, provide Grade 1HD-100.
 - 6. For trash bins not more than 20 inches high and 16 inches wide, provide Grade 1HD-200.
- H. Door Locks: BHMA A156.11, E07121.
- I. Drawer Locks: BHMA A156.11, E07041.
- J. Door and Drawer Silencers: BHMA A156.16, L03011.
- K. Grommets for Cable Passage through Countertops: Diameter and color as selected by Architect, molded-plastic grommets and matching plastic caps with slot for wire passage.
 - 1. Product: Subject to compliance with requirements, provide grommets by Doug Mockett & Company, Inc.
- L. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - 1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
 - 2. Satin Stainless Steel: BHMA 630.
- M. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.4 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. Adhesives: Do not use adhesives that contain urea formaldehyde.

2.5 FABRICATION

- A. Fabricate cabinets to dimensions, profiles, and details indicated.
 - 1. For countertops provide front and end overhang of 1 inch over base cabinets. Ease edges to radius indicated.
- B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.

3.2 INSTALLATION

- A. Grade: Install cabinets to comply with same grade as item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.
 - 1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items.
 - 2. Seal edges of cutouts by saturating with varnish.
- C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.

1. Use filler matching finish of items being installed.
- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 2. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.
 3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semi-exposed surfaces.

END OF SECTION 064116

SECTION 06 64 00

PLASTIC PANELING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic sheet paneling.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.3 QUALITY ASSURANCE

A. Testing Agency: Acceptable to authorities having jurisdiction.

1.4 PROJECT CONDITIONS

- ###### A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- ###### A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

2.2 PLASTIC SHEET PANELING

- ###### A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D 5319.

1. Basis-of-Design Products: Subject to compliance with requirements, provide plastic paneling indicated on Drawings or comparable products by one of the following:

- a. Crane Composites, Inc.
- b. Marlite.

- c. Nudo Products, Inc.
 - d. Panolam Industries International
- 2. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E 84. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
- 3. Nominal Thickness: Not less than 0.09 inch.
- 4. Surface Finish: Pebbled.
- 5. Color: As indicated.

2.3 ACCESSORIES

- A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.
 - 1. Color: Match panels.
- B. Adhesive: As recommended by plastic paneling manufacturer.
 - 1. Adhesives shall have a VOC content of 50 g/L or less.
- C. Sealant: Mildew-resistant, single-component, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 079200 "Joint Sealants."
 - 1. Sealant shall have a VOC content of 250 g/L or less.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.
- B. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.
- C. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

- D. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels.
 - 1. Mark plumb lines on substrate at panel joint locations for accurate installation.
 - 2. Locate panel joints to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

- A. Install plastic paneling according to manufacturer's written instructions.
- B. Install panels in a full spread of adhesive.
- C. Install trim accessories with adhesive.
- D. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.
- E. Maintain uniform space between panels and wall fixtures. Fill space with sealant.
- F. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 066400

SECTION 07 19 00

WATER REPELLENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes penetrating treatments for the following horizontal surfaces:

1. Existing cast-in-place concrete.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1. Include manufacturer's printed statement of VOC content.
2. Include manufacturer's recommended number of coats for each type of substrate and spreading rate for each separate coat.

1.3 QUALITY ASSURANCE

- A. Applicator Qualifications: An employer of workers trained and approved by manufacturer.

1.4 PROJECT CONDITIONS

- A. Limitations: Proceed with application only when the following existing substrate conditions permit concrete treatments to be applied according to manufacturers' written instructions and warranty requirements:

1. Concrete surfaces and mortar have cured for not less than 28 days.
2. Building has been closed in for not less than 30 days before treating wall assemblies.
3. Ambient temperature is above 40 deg F and below 100 deg F and will remain so for 24 hours.
4. Not less than seven days have passed since surfaces were last wet.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agree(s) to repair or replace materials that fail to maintain water repellency within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Products: Subject to compliance with requirements, provide products indicated on Drawings, or comparable product by one of the following:
 - 1. BASF Construction Chemicals, LLC.
 - 2. PROSOCO, Inc.
 - 3. Tamms Industries, Inc., Euclid Chemical Company (The).
 - 4. Tnemec Inc.

2.2 PRODUCTS

- A. Pre-Densifier Concrete Cleaner: Cleaner to remove dirt, oil, grease, and other stains from existing slab surface.
- B. Penetrating Concrete Hardener/Densifier: Lithium silicate hardener/densifier.
 - 1. Performance Requirements:
 - a. Abrasion Resistance: Greater than 50 percent improvement over untreated samples when tested in accordance with ASTM C1353.
 - b. Coefficient of Friction: Greater than 0.60 dry, Greater than 0.60 wet when tested in accordance with ASTM C1028.
 - c. Adhesion: Greater than 10 percent increase in pull-off strength when compared to an untreated sample when tested in accordance with ASTM D4541.
 - d. Water Vapor Transmission: 100 percent retained when compared to untreated samples when tested in accordance with ASTM E96/96M Method B (Water Method).
 - e. UV Stability: No degradation or yellowing of material when tested in accordance with ASTM G154.
- C. Penetrating Water Repellent: Clear, water-based, low-odor, penetrating repellent with 100 g/L or less of VOCs.
 - 1. Performance Requirements:
 - a. Coefficient of Friction: Greater than 0.60 dry, greater than 0.60 wet when tested in accordance with ASTM C1028.
 - b. Stain Resistance: Achieve limited or no adverse effects when tested in accordance with ASTM D1038.
 - c. Water Vapor Transmission: 100 percent retained when compared to untreated samples when tested in accordance with ASTM E96/96M Method B (Water Method).
 - d. UV Stability: No degradation or yellowing of material when tested in accordance with ASTM G154.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.
 - 1. Verify that surfaces are clean and dry according to concrete treatment manufacturer's requirements. Check moisture content in two representative locations by method recommended by manufacturer.
 - 2. Inspect for previously applied treatments that may inhibit penetration or performance of concrete treatments.
 - 3. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of concrete treatments.
 - 4. Verify that required repairs are complete, cured, and dry before applying concrete treatments.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Cleaning: Before application of concrete treatments, clean substrate of substances that could impair penetration or performance of product according manufacturer's written instructions and as follows:
 - 1. Cast-in-Place Concrete: Remove oil, curing compounds, laitance, and other substances that inhibit penetration or performance concrete treatments according to ASTM E 1857.
- B. Protect adjoining work from spillage of concrete treatments
- C. Coordination with Sealant Joints: Do not apply concrete treatments until sealants for joints adjacent to surfaces receiving concrete treatments have been installed and cured.

3.3 CONCRETE POLISHING

- A. Adhere to industry standard polishing procedures for dry and wet grinding/polishing.
- B. Scrub and rinse slab surface with clean water and vacuum with auto-scrubber between and after final polishing passes.
- C. Sequential progression of diamond polishing steps shall be required and limited to no more than double the grit value of the previous diamonds used.
- D. Overlap adjacent polishing passes by 25 percent.
- E. Perform each pass perpendicular to the other pass north/south then east/west; multiple passes may be needed.
- F. Progressively grind and polish the slab surface utilizing approved diamond segments as necessary to produce finish to match Architect's sample.

3.4 APPLICATION

- A. Apply concrete hardener/densifier to cured concrete according to manufacturer's written instructions and as follows:
 - 1. Remove remnants of bond breakers, curing agents, surface grease and oil and construction debris.
 - 2. Apply hardener/densifier per manufacturer's recommended application rate to designated finished floor area, with a low-pressure sprayer fitted with a 0.5 gpm spray tip.
 - 3. Apply sufficient material to wet the surface without producing puddles. Use a clean soft-bristle push broom or microfiber pad to spread the hardener/densifier evenly to achieve uniform wetting. Avoid spreading once drying begins. Surface should remain wet for 5 to 10 minutes. Allow treated surface to dry.
 - 4. Once thoroughly dry, concrete may be auto-scrubbed, buffed or burnished. Buffing or burnishing should be performed with the appropriate pad.
- B. Apply water repellent on surfaces indicated according to manufacture's written instructions and as follows:
 - 1. Apply a heavy-saturation coating of water repellent, on surfaces indicated for treatment, using 15 psi- pressure spray with a fan-type spray nozzle to the point of saturation.
 - 2. Apply coating in dual passes of uniform, overlapping strokes.
 - 3. Remove excess material; do not allow material to puddle beyond saturation.

3.5 CLEANING

- A. Immediately clean concrete treatments from adjoining surfaces and surfaces soiled or damaged by concrete treatment application as work progresses. Correct damage to work of other trades caused by concrete treatment application, as approved by Architect.
- B. Comply with manufacturer's written cleaning instructions.

3.6 PROTECTION

- A. Protect finished floors to prevent damage including staining, gouges and scratching by construction traffic and activities.

END OF SECTION 071900

SECTION 07 21 00

THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass-fiber blanket insulation.
2. Mineral-wool blanket insulation.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 - PRODUCTS

2.1 GLASS-FIBER BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CertainTeed Corporation.
2. Johns Manville.
3. Owens Corning.

- B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
- C. Polypropylene-Scrim-Kraft-Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type II (non-reflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier).
- D. Reinforced-Foil-Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.

2.2 MINERAL-WOOL BLANKET INSULATION

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Fibrex Insulations Inc.
 - 2. Owens Corning.
 - 3. Roxul Inc.
 - 4. Thermafiber.
- B. Unfaced, Mineral-Wool Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Glass-Fiber Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically.

3.4 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

- A. Where glass-fiber blankets are indicated for sound attenuation above ceilings, install blanket insulation over entire ceiling area in thicknesses indicated. Extend insulation 48 inches up either side of partitions.

3.5 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 07 25 00

WEATHER BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Building paper.
2. Flexible flashing.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for plywood sheathing joint and penetration treatment.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 WATER-RESISTIVE BARRIER

- A. Building Paper: Water-vapor-permeable, asphalt-saturated kraft building paper that complies with ICC-ES AC38, Grade D.
- B. Building Wrap: ASTM E 1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.
 - 1. Basis of Design Product: Subject to compliance with requirements, provide Tyvek Commercial Wrap D manufactured by DuPont (E. I. du Pont de Nemours and Company), or comparable product by the following:
 - a. Dow Chemical Company (The).
- C. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.2 MISCELLANEOUS MATERIALS

- A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

1. Basis of Product: Subject to compliance with requirements, provide StriaghtFlash manufactured by DuPont (E. I. du Pont de Nemours and Company), or comparable product by the following:
 - a. Grace Construction Products, a unit of W. R. Grace & Co.
 - b. Protecto Wrap Company.
 - c. Carlisle Coatings & Waterproofing.
 - d. Fortifiber Building Systems Group.
- B. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.
- C. Nails and Staples: ASTM F 1667.

PART 3 - EXECUTION

3.1 WATER-RESISTIVE BARRIER INSTALLATION

- A. Cover exposed exterior surface of sheathing with water-resistive barrier securely fastened to framing immediately after sheathing is installed.
- B. Cover sheathing with water-resistive barrier as follows:
 1. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
 2. Apply barrier to cover vertical flashing with a minimum 4-inch overlap unless otherwise indicated.
- C. Building Paper: Apply horizontally with a 2-inch overlap and a 6-inch end lap; fasten to sheathing with galvanized staples or roofing nails.
- D. Building Wrap: Comply with manufacturer's written instructions and warranty requirements.

3.2 FLEXIBLE FLASHING INSTALLATION

- A. Apply flexible flashing where indicated to comply with manufacturer's written instructions.
 1. Prime substrates as recommended by flashing manufacturer.
 2. Lap seams and junctures with other materials at least 4 inches except that at flashing flanges of other construction, laps need not exceed flange width.
 3. Lap flashing over water-resistive barrier at bottom and sides of openings.
 4. Lap water-resistive barrier over flashing at heads of openings.
 5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

END OF SECTION 072500

SECTION 07 42 13

FORMED METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concealed-fastener, lap-seam metal wall panels.

B. Related Requirements:

1. Section 07 25 00 "Weather Barriers" for weather-resistive barriers.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference:** Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data:** For each type of product.

- B. Shop Drawings:** Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

- C. Samples:** For each type of metal panel and finish indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data:** For Installer.

- B. Product Test Reports:** For each product, tests performed by a qualified testing agency.

- C. Warranties:** Samples of special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data:** For metal panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications:** An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation.

1.8 COORDINATION

- A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings.
 - 3. Deflection Limits: For wind loads, no greater than 1/180 of the span.
- B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 1.57 lbf/sq. ft.

- C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- E. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS

- A. General: Provide factory-formed metal panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.
- B. Tapered-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with raised, trapezoidal major ribs and a flat pan between major ribs.
 - 1. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation, or Aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Nominal Thickness: 18 gage (1.19 mm).
 - b. Panel Coverage: 91.5 cm.
 - c. Panel Height: 38 mm.
 - d. Exterior Finish: Three-coat fluoropolymer.
 - e. Color: As selected by Architect from manufacturer's full range.

2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A 792/A 792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
1. Clips: Provide Integrity attachment clips as recommended by panel manufacturer.
- E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
 2. Joint Sealant: ASTM C 920; as recommended in writing by metal panel manufacturer.
 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.4 FABRICATION

- A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 2. Seams: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
4. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Steel Panels and Accessories:
 1. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.2 METAL PANEL INSTALLATION

- A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 1. Shim or otherwise plumb substrates receiving metal panels.
 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
 3. Install screw fasteners in predrilled holes.
 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 5. Install flashing and trim as metal panel work proceeds.

6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
5. Flash and seal panels with weather closures at perimeter of all openings.

E. Watertight Installation:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

3.3 CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

END OF SECTION 074213

SECTION 07 54 19

POLYVINYL-CHLORIDE (PVC) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Adhered polyvinyl-chloride (PVC) roofing system.
2. Cover Board.
3. Rigid Roof Insulation.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for wood nailers, curbs, and blocking; and for wood-based, structural-use roof deck panels.
2. Section 07 21 00 "Thermal Insulation" for insulation beneath the roof deck.
3. Section 07 62 00 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
4. Section 07 92 00 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
5. Section 22 00 00 "Plumbing Systems" for storm drainage piping specialties for roof drains.

1.2 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.3 PREINSTALLATION MEETINGS

- A. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review deck substrate requirements for conditions and finishes, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.

8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

B. Pre-installation Roofing Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work, including:

1. Base flashings and membrane terminations.
2. Tapered insulation, including slopes.
3. Roof plan showing orientation of steel roof deck and orientation of roofing, fastening spacings, and patterns for mechanically fastened roofing.
4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

C. Samples for Verification: For the following products:

1. Sheet roofing, of color required.
2. Walkway pads or rolls, of color required.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article and Quality Assurance as described in Section 1.7 of this specification.

1. Submit evidence of compliance with performance and quality assurance requirements.

- C. Product Test Reports: For components of roofing system, for tests performed by manufacturer and witnessed by a qualified testing agency.
- D. Research/Evaluation Reports: For components of roofing system, from ICC-ES.
- E. Field quality-control reports.
- F. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is UL listed and FM Global approved for roofing system identical to that used for this Project.
- B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty. Contractor shall have a minimum of 5 years' experience as an applicator for the membrane products manufacturer.
- C. Membrane Manufacturer must certify that the proposed equal has a membrane thickness equal to the membrane thickness specified, 72 mils thick, without ASTM (+/-) mil tolerances, as such tolerances are not acceptable. The felt backing shall not be included when measuring membrane thickness.
- D. Membrane must have at least thirty-six (36) mils of waterproofing polymers above the reinforcement as documented in the Typical Physical Properties section of the Manufacturer's published Product Data Sheet 72 mil membranes, respectively.
- E. Roofing Membrane Manufacturer must have a demonstrated performance history of producing thermoplastic membranes no less, in duration of years, than the warranty duration specified.
- F. Membrane Manufacturer must provide a list of at least 10 (ten) projects in which the submitted roofing material has been performing for the specified warranty duration. Membranes with modified formulation changes and undocumented proven performance will not be accepted.
- G. Membrane Manufacturer must not require the use of membrane cut edge sealant at any location. This is a maintenance item that the Owner does not accept.
- H. Manufacturer's warranty must have "No Dollar Limit" for the replacement of defective materials and labor with no exclusions for ponding water. Warranty shall not exclude foot traffic and storage on the membrane surface. Warranty shall not obligate the owner to a maintenance schedule or requirements as a condition of the warranty.
- I. Membrane Manufacturer to confirm in writing that they directly manufacture the roofing membrane; private labeled membranes are not acceptable.
- J. Membrane Manufacturer must have an established program for recycling membrane at the end of its useful life. Must provide 3 (three) instances in which they have done so.

- K. Membrane Manufacturer must have recycled content certification from UL (Underwriters Laboratories) Environment.
- L. Membrane Manufacturer must have ISO 14001 Certification and a Responsible Care program in place.
- M. Upon completion of the installation and the delivery to the Manufacturer, by the Applicator of certification, that all work has been done in strict accordance with the contract specifications and Membrane Manufacturer's requirements, a Technical Service Representative will review the installed roof system.
- N. There is no deviation made from the project specification or the approved shop drawings without prior written approval by the Architect, the Owner's Representative and Roofing Manufacturer.
- O. All work pertaining to the installation of PVC membrane and flashings must only be completed by Applicator personnel trained and authorized by roofing Manufacturer in those procedures.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Special warranty provides for all supplied system components which include membrane roofing, base flashings, roof insulation, fasteners, cover boards, roofing accessories, and

other components of that comprise a roofing system. Warranty shall be non-prorated and have no dollar amount (NDL).

2. Warranty Period: 20 years from date of Substantial Completion. The warranty shall not exclude the condition of ponding water or foot traffic and storage of any items upon the roof surface. The warranty shall not obligate the owner to maintenance requirements or a schedule as a condition of the warranty.

- B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as membrane roofing, base flashing, roof insulation, fasteners, cover boards, and walkway products, for the following warranty period:

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain components including roof insulation, fasteners, adhesive, cover board and other accessories as required for the roofing system from the roofing membrane roofing manufacturer and other manufacturers as approved by the membrane manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.
 1. Accelerated Weathering: Roofing system shall withstand 10,000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
 2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.
- B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.
- C. FM Global Listing: Roofing, base flashings, and component materials shall comply with requirements in FM Global 4450 or FM Global 4470 as part of a built-up roofing system, and shall be listed in FM Global's "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.
 1. Fire/Windstorm Classification: Class 1A-90.
- D. Solar Reflectance Index: Not less than 104 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
- E. Energy Star Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low slope roof products.

- F. Energy Performance: Roofing system shall have an initial solar reflectance of not less than 0.83 and an emissivity of not less than 0.90 when tested according to CRRC-1.
- G. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- H. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.3 PVC ROOFING

- A. PVC Sheet: ASTM D 4434/D 4434M, Type II or Type III, glass-fiber reinforced (Type II) or polyester-reinforced (Type III), felt or fleece backed.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. GAF.
 - b. Johns Manville.
 - c. Sika Sarnafil.
 - 2. Thickness: 80 mil membrane thickness.
 - 3. Exposed Face Color: White, meeting CCR Title 24 Reflectivity and Emissivity requirements.

2.4 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.
 - 1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
 - 2. Adhesives and sealants shall comply with the following limits for VOC content:
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.
 - c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Contact Adhesives: 80 g/L.
 - f. PVC Welding Compounds: 510 g/L.
 - g. Other Adhesives: 250 g/L.
 - h. Single-Ply Roof Membrane Sealants: 450 g/L.
 - i. Non-membrane Roof Sealants: 300 g/L.
 - j. Sealant Primers for Nonporous Substrates: 250 g/L.
 - k. Sealant Primers for Porous Substrates: 775 g/L.
- B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as PVC sheet. Flashing membrane shall be 60 mils thick.
- C. Bonding Adhesive: Manufacturer's standard VOC compliant water based.
- D. Slip Sheet: Manufacturer's standard, of thickness required for application.

- E. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- F. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, pre-punched.
- G. Fasteners: Factory-coated steel fasteners and metal plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roofing to substrate, and acceptable to roofing system manufacturer.
- H. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, and other accessories.

2.5 COVER BOARDS

- A. Cover Board: ASTM C 1177/C glass-mat, water-resistant gypsum substrate, 1/4-inch thick, Dens Deck by Georgia Pacific.

2.6 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or supplied by PVC roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Global-approved roof insulation.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2 felt or glass-fiber mat facer on both major surfaces. Provide rigid insulation to achieve R-38 value.
- C. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.7 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with roofing.
- B. Fasteners: Factory-coated steel fasteners and metal plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.
- C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation as follows:
 1. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
 2. Full-spread spray-applied, low-rise, two-component urethane adhesive.

2.8 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway rolls, approximately 3/16 inch (5 mm, 96 mils) thick and acceptable to roofing system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:
 - 1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
 - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that the nailers match thicknesses of insulation.
 - 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."
 - 4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
 - 5. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 6. Verify that concrete-curing compounds that will impair adhesion of roofing components to roof deck have been removed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Install roofing system according to roofing system manufacturer's written instructions.
- D. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.3 INSULATION AND COVER BOARD INSTALLATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.
- D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

1. Where installing composite and non-composite insulation in two or more layers, install non-composite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
- E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
- G. Loosely lay base layer of insulation units over substrate.
- H. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches from previous layer of insulation.
- I. Loosely lay each layer of insulation units over substrate.
- J. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together and fasten to roof deck.
1. Fasten cover boards according to requirements in FM Global's "RoofNav" for specified Windstorm Resistance Classification.
 2. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturers' written instructions.

3.4 ADHERED ROOFING INSTALLATION

- A. Adhere roofing over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing and allow the sheet to relax before retaining.
1. Install sheet according to ASTM D 5036.
- B. Start installation of roofing in presence of roofing system manufacturer's technical personnel.
- C. Accurately align roofing, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Bonding Adhesive: Apply to substrate and underside of roofing at rate required by manufacturer, and allow to partially dry before installing roofing. Do not apply to splice area of roofing or on the feltbacking.
- E. In addition to adhering, mechanically fasten roofing securely at terminations, penetrations, and perimeter of roofing.
- F. Apply roofing with side laps shingled with slope of roof deck where possible.
- G. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roofing and sheet flashings according to manufacturer's written instructions, to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity.
 2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
 3. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.
- H. Spread sealant bed over deck-drain flange at roof drains, and securely seal roofing in place with clamping ring.

3.5 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.6 WALKWAY INSTALLATION

- A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish reports to Architect.
- B. Flood Testing: Flood test each roofing area for leaks, according to recommendations in ASTM D 5957, after completing roofing and flashing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
 1. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and not exceeding a depth of 4 inches. Maintain 2 inches of clearance from top of base flashing.
 2. Flood each area for 24 hours.
 3. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.
- C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
- D. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.8 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.9 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
 - 1. Owner: Grossmont Union High School District.
 - 2. Building Name/Type: Mount Miguel High School Phase 1 Modernization.
 - 3. Area of Work: _____.
 - 4. Acceptance Date: _____.
 - 5. Warranty Period: As indicated.
- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
 - 1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding those indicated on Drawings;
 - c. fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION 075419

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manufactured reglets with counterflashing.
2. Formed roof-drainage sheet metal fabrications.
3. Formed low-slope roof sheet metal fabrications.
4. Formed wall sheet metal fabrications.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Distinguish between shop- and field-assembled work.
3. Include identification of finish for each item.
4. Include pattern of seams and details of termination points, expansion joints and expansion-joint covers, direction of expansion, roof-penetration flashing, and connections to adjoining work.

- C. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

- A. Product certificates.

- B. Product test reports.

- C. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.7 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

- 1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. SPRI Wind Design Standard: Manufacture and install copings tested according to SPRI ES-1 and capable of resisting the following design pressure:
 - 1. Design Pressure: As indicated on Drawings.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 (Z275) coating designation); prepainted by coil-coating process to comply with ASTM A 755/A 755M.
 - 1. Exposed Coil-Coated Finish:
 - a. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2. Color: Match Architect's sample.

2.3 UNDERLAYMENT MATERIALS

- A. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.
- B. Self-Adhering, High-Temperature Sheet: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Grace Construction Products, a unit of W. R. Grace & Co.-Conn.; Ultra.
 - b. Protecto Wrap Company; Protecto Jiffy Seal Ice & Water Guard HT.
 2. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F or higher.
 3. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F or lower.
- C. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
 2. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.
- C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
- D. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

1. Product: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation: 795.
 - b. General Electric: SCS2000 SilPruf..
- E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- F. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.
- G. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 MANUFACTURED REGLETS

- A. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions and with interlocking counterflashing on exterior face, of same metal as reglet.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cheney Flashing Company.
 - b. Fry Reglet Corporation.
 - c. Heckmann Building Products, Inc.
 - d. Hickman, W. P. Company.
 - e. Hohmann & Barnard, Inc.
 - f. Keystone Flashing Company, Inc.
 - g. National Sheet Metal Systems, Inc.
 - h. Sandell Manufacturing.
 2. Material: Galvanized steel, 0.022 inch thick.
 3. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
 4. Accessories:
 - a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
 - b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.
 5. Finish: Mill.

2.6 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 1. Obtain field measurements for accurate fit before shop fabrication.

2. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 3. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- C. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- D. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- E. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.
- F. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

2.7 ROOF-DRAINAGE SHEET METAL FABRICATIONS

- A. Downspouts: Fabricate round or rectangular downspouts to dimensions indicated, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors. Shop fabricate elbows.
1. Hanger Style: As indicated.
 2. Fabricate from the following materials:
 - a. Galvanized Steel: 0.022 inch thick.
- B. Parapet Scuppers: Fabricate scuppers to dimensions required, with closure flange trim to exterior, 4-inch- wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. Fabricate from the following materials:
1. Galvanized Steel: 0.028 inch thick.
- C. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape required, complete with outlet tubes. Fabricate from the following materials:
1. Galvanized Steel: 0.028 inch thick.

2.8 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Copings: Fabricate in minimum 96-inch- long, but not exceeding 12-foot- long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support

edge of external leg and interior leg. Miter corners, fasten and seal watertight. Shop fabricate interior and exterior corners.

1. Fabricate from the Following Materials:

a. Galvanized Steel: 0.040 inch thick.

B. Base Flashing: Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch thick.

C. Counterflashing and Flashing Receivers: Fabricate from the following materials:

1. Galvanized Steel: 0.022 inch thick.

D. Roof-Penetration Flashing: Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch thick.

E. Roof-Drain Flashing: Fabricate from the following materials:

1. As indicated on Drawings.

F. Opening Flashings in Frame Construction: Fabricate head, sill,[jamb,] and similar flashings to extend 4 inches (100 mm) beyond wall openings. Form head and sill flashing with 2-inch- (50-mm-) high, end dams. Fabricate from the following materials:

1. Galvanized Steel: 0.022 inch thick.

PART 3 - EXECUTION

3.1 UNDERLAYMENT INSTALLATION

A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

B. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller. Cover underlayment within 14 days.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of sealant.
 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
 5. Torch cutting of sheet metal flashing and trim is not permitted.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
1. Coat concealed side of stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."
- G. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.3 ROOF-DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.
- B. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c.
- C. Parapet Scuppers: Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.

- D. Conductor Heads: Anchor securely to wall, with elevation of conductor head rim at minimum of 1 inch below scupper discharge.
- E. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints minimum of 4 inches in direction of water flow.

3.4 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate.
- C. Copings: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated.
- D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.
- E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints minimum of 4 inches.
- F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with butyl sealant and clamp flashing to pipes that penetrate roof.

3.5 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Reglets: Installation of reglets is specified in Section 042000 "Unit Masonry."
- C. Opening Flashings in Frame Construction: Install continuous head, sill, and similar flashings to extend 4 inches beyond wall openings.

3.6 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean off excess sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

END OF SECTION 076200

SECTION 07 84 13

PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Penetrations in fire-resistance-rated walls.
 - 2. Penetrations in horizontal assemblies.
 - 3. Penetrations in smoke barriers.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.
 - 1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."
- B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
 - 1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.

2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
 - a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
 - b. Classification markings on penetration firestopping correspond to designations listed by the following:
 - 1) UL in its "Fire Resistance Directory."
 - 2) FM Global in its "Building Materials Approval Guide."
- C. Preinstallation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.6 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.
- C. Notify Owner's testing agency at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. A/D Fire Protection Systems Inc.
 2. Grace Construction Products.
 3. Specified Technologies Inc.
 4. 3M Fire Protection Products.
 5. Tremco, Inc.; Tremco Fire Protection Systems Group.

2.2 PENETRATION FIRESTOPPING

- A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
- B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
 - 1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
 - 1. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
 - 2. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
- D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.
 - 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.
- E. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- F. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
- G. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.
 - 1. Permanent forming/damming/backing materials, including the following:
 - a. Slag-wool-fiber or rock-wool-fiber insulation.
 - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - c. Fillers for sealants.
 - 2. Temporary forming materials.
 - 3. Substrate primers.
 - 4. Collars.

5. Steel sleeves.

2.3 FILL MATERIALS

- A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.
- E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
- I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

2.4 MIXING

- A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

- A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.
- C. Install fill materials for firestopping by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - 1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Designation of applicable testing and inspecting agency.
 - 4. Date of installation.
 - 5. Manufacturer's name.
 - 6. Installer's name.

3.5 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

END OF SECTION 078413

SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes joint sealants for the following applications:
 - 1. Interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 2. Interior joints in vertical surfaces and horizontal nontraffic surfaces requiring mildew-resistant sealants.
 - 3. Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces.
 - 4. Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 5. Exterior joints in horizontal traffic surfaces.

1.2 PRECONSTRUCTION TESTING

- A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
 - 1. Use manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - 2. Submit not fewer than eight pieces of each kind of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
 - 3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
 - 5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples: For each kind and color of joint sealant required.
- C. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.

3. Joint-sealant formulation.
4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- C. Field-Adhesion Test Reports: For each sealant application tested.
- D. Warranties.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

1.7 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 2. When joint substrates are wet.
 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 WARRANTY

- A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 2. Disintegration of joint substrates from natural causes exceeding design specifications.

3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 1. Architectural Sealants: 250 g/L.
 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 3. Sealant Primers for Porous Substrates: 775 g/L.
- B. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on field experience.
- C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- D. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- E. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 JOINT SEALANTS

- A. Joint Sealant Type 1: Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant, per ASTM C 920, Type S, Grade NS, Class 50, for Use NT.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; Omniseal 50.
 - b. Dow Corning Corporation; 756 SMS or 795.
 - c. May National Associates, Inc.; Bondaflex Sil 295.
 - d. Pecora Corporation; 864.
 - e. Sika Corporation, Construction Products Division; SikaSil-C995.
 - f. Tremco Incorporated; Spectrem 2 or Spectrem 3.
- B. Joint Sealant Type 2: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; Sonolac.
 - b. Bostik, Inc.; Chem-Calk 600.
 - c. May National Associates, Inc.; Bondaflex 600 or Bondaflex Sil-A 700.

- d. Pecora Corporation; AC-20+.
 - e. Schnee-Morehead, Inc.; SM 8200.
 - f. Tremco Incorporated; Tremflex 834.
- C. Joint Sealant Type 3a: Single-component, nonsag, traffic-grade, urethane joint sealant: ASTM C 920, Type S, Grade NS, Class 25, for Uses T and I.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; Sonolastic NP1.
 - b. Sika Corporation, Construction Products Division; Sikaflex - 1a.
 - c. Tremco Incorporated; Vulkem 116.
- D. Joint Sealant Type 3b: Single-component, pourable, traffic-grade, urethane joint sealant: ASTM C 920, Type S, Grade P, Class 25, for Uses T and I.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Sika Corporation, Construction Products Division; Sikaflex - 1CSL.
 - b. Tremco Incorporated; Vulkem 45.
- E. Joint Sealant Type 4: Mildew-resistant, single-component, silicone joint sealant, per ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Pecora Corporation; 898.
 - b. BASF Building Systems; Omniplus.
 - c. Dow Corning Corporation; 786 Mildew Resistant.
 - d. GE Advanced Materials - Silicones; Sanitary SCS1700.
 - e. May National Associates, Inc.; Bondaflex Sil 100 WF.
 - f. Tremco Incorporated; Tremsil 200 Sanitary.
- F. Joint Sealant Type 5: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834, which effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Pecora Corporation; AC-20 FTR or AIS-919.
 - b. USG Corporation; SHEETROCK Acoustical Sealant.

2.3 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type B (bicellular material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.4 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove laitance and form-release agents from concrete.
 - 2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
 - 4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
 - 5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.
- G. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
 - 1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform 1 test for each kind of sealant and joint substrate.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 3. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
 4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
 5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
 1. Joint Locations:

- a. Construction joints in cast-in-place concrete.
- b. Control and expansion joints in unit masonry.
- c. Joints in portland cement plastering systems.
- d. Joints between metal panels.
- e. Joints in exterior finish carpentry.
- f. Joints between different materials listed above.
- g. Perimeter joints between materials listed above and frames of doors, windows and louvers.
- h. Control and expansion joints in ceilings and other overhead surfaces.
- i. Other joints as indicated.

Joint Sealant Product: Joint Sealant Type 1.

B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

- a. Control and expansion joints on exposed interior surfaces of exterior walls.
- b. Perimeter joints of exterior openings where indicated.
- c. Control and expansion joints in tile.
- d. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
- e. Other joints as indicated.

2. Joint Sealant Product: Joint Sealant Type 2.

C. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.

1. Joint Locations:

- a. Control and expansion joints in unit masonry.
- b. Control and expansion joints in tile.
- c. Joints between different materials listed above.
- d. Other joints as indicated.

2. Joint Sealant Product: Joint Sealant Type 3a or 3b.

D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces requiring mildew-resistant sealants.

1. Joint Sealant Location:

- a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
- b. Tile control and expansion joints where indicated.
- c. Other joints as indicated.

2. Joint Sealant Product: Joint Sealant Type 4.

E. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Location:

- a. Acoustical joints where indicated.
- b. Other joints as indicated.

1. Joint Sealant Product: Joint Sealant Type 5.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

END OF SECTION 079200

SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes hollow-metal work.
- B. Related Requirements:
 - 1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

1.2 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.3 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, joints, field splices, and connections.
 - 7. Details of accessories.
 - 8. Details of moldings, removable stops, and glazing.
 - 9. Details of conduit and preparations for power, signal, and control systems.

- C. Samples for Verification: For each type of exposed finish required.
- D. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.
- A. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 - 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ceco Door Products; an Assa Abloy Group company.
 - 2. Pioneer Industries, Inc.
 - 3. Steelcraft; an Ingersoll-Rand company.
 - 4. Western Integrated Materials, Inc.

2.2 REGULATORY REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - 1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

- B. Fire-Rated, Borrowed-Light Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.3 INTERIOR DOORS AND FRAMES

- A. Heavy-Duty Doors and Frames: SDI A250.8, Level 2.

- 1. Physical Performance: Level B according to SDI A250.4.
- 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches.
 - c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.042 inch.
 - d. Edge Construction: Model 2, Seamless.
 - e. Core: Manufacturer's standard polyurethane core.
- 3. Frames:
 - a. Materials: Uncoated, steel sheet, minimum thickness of 0.053 inch.
 - b. Construction: Full profile welded.
- 4. Exposed Finish: Prime.

2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3.

- 1. Physical Performance: Level A according to SDI A250.4.
- 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches.
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
 - d. Edge Construction: Model 2, Seamless.
 - e. Core: Manufacturer's standard polyurethane core.
- 3. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
 - b. Construction: Full profile welded.
- 4. Exposed Finish: Prime.

2.5 FRAME ANCHORS

- A. Jamb Anchors:

- 1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.

- B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch and as follows:

- 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.6 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- G. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- H. Glazing: Comply with requirements in Section 088000 "Glazing."
- I. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.7 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
 - 1. Fire Door Cores: As required to provide fire-protection ratings indicated.
 - 2. Vertical Edges for Single-Acting Doors: Provide beveled or square edges at manufacturer's discretion.
 - 3. Top Edge Closures: Close top edges of doors with inverted closures, except provide flush closures at exterior doors of same material as face sheets.

4. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
 5. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 6. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
1. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 3. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor.
 4. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - b. Compression Type: Not less than two anchors in each frame.
 - c. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
 5. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
 6. Terminated Stops: Terminate stops 6 inches above finish floor with a 45-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.
- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

- F. Stops and Moldings: Provide stops and moldings around louvers where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 4. Provide loose stops and moldings on inside of hollow-metal work.
 5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.8 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.9 ACCESSORIES

- A. Louvers: Provide louvers for interior doors, where indicated, which comply with SDI 111C, with blades or baffles formed of 0.020-inch- thick, cold-rolled steel sheet set into 0.032-inch- thick steel frame.
1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.
 2. Lightproof Louver: Stationary louvers constructed with baffles to prevent light from passing from one side to the other.
- B. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable stops located on secure side of opening.
 - d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - e. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 - 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
 - 4. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Steel Doors:

- a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
 - c. At Bottom of Door: 5/8 inch plus or minus 1/32 inch.
 - d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.
- 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- 3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.
- D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.
 - 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- C. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

SECTION 08 14 16

FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-core doors with MDO faces.
2. Factory fitting flush wood doors to frames and factory machining for hardware.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of door indicated. Include details of core and edge construction and trim for openings.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Dimensions and locations of blocking.
2. Indicate dimensions and locations of mortises and holes for hardware.
3. Indicate dimensions and locations of cutouts.
4. Undercuts.
5. Indicate fire-protection ratings for fire-rated doors.

C. Samples for Verification:

1. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

B. Quality Standard Compliance Certificates: WI Certified Compliance Program certificates.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain flush wood doors from single manufacturer.

- B. Quality Standard: In addition to requirements specified, comply with AWI's and WI's "Architectural Woodwork Standards."
 - 1. Provide WI-Certified Compliance Certificate indicating that doors comply with requirements of grades specified.
 - 2. Provide WI-Certified Compliance Certificate for installation.
- C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - 1. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.
- C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
 - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
 - 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 - 3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide flush wood doors by one of the following:
1. Algoma Hardwoods, Inc.
 2. Eggers Industries.
 3. Marshfield Door Systems, Inc.
 4. VT Industries, Inc.

2.2 DOOR CONSTRUCTION, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."
- B. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.
 3. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
 4. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
 5. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
- C. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.
- D. Structural-Composite-Lumber-Core Doors:
1. Structural Composite Lumber: WDMA I.S.10.
 - a. Screw Withdrawal, Face: 700 lbf.
 - b. Screw Withdrawal, Edge: 400 lbf.
- E. Mineral-Core Doors:
1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
 2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.

3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

2.3 DOORS FOR OPAQUE FINISH

A. Interior Solid-Core Doors:

1. Grade: Custom.
2. Faces: MDO.
3. Exposed Vertical and Top Edges: Any closed-grain hardwood.
4. Core: Either glued wood stave or structural composite lumber.
5. Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering.

2.4 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

1. Comply with requirements in NFPA 80 for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

2.5 SHOP PRIMING

A. Doors for Opaque Finish: Shop prime faces, all four edges, edges of cutouts, and mortises with one coat of wood primer specified in Section 09 91 23" Interior Painting."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Division 08 Section "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
 - 1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
 - 2. Install smoke- and draft-control doors according to NFPA 105.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 08 31 13

ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes access doors and frames for walls and ceilings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Samples: For each type of access door and frame and for each finish specified, complete assembly minimum 6 by 6 inches in size.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Babcock-Davis.
 - 2. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
 - 3. Larsen's Manufacturing Company.
 - 4. Nystrom, Inc.

2.2 ACCESS DOORS AND FRAMES

- A. Recessed Access Doors with Concealed Flanges:
 - 1. Description: Door face recessed 5/8 inch for gypsum board infill; with concealed flange for gypsum board installation and concealed hinge.
 - 2. Locations: Wall and ceiling.
 - 3. Door Size: As indicated on Drawings.
 - 4. Aluminum Sheet for Door: Nominal 0.045 inch, with manufacturer's standard baked-enamel or powder-coat finish.
 - 5. Latch and Lock: As indicated on Drawings.

2.3 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, Alloy 6063.

- B. Aluminum Sheet: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- C. Frame Anchors: Same material as door face.

2.4 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
 - 1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
- D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling. Provide access sleeves for each latch operator and install in holes cut through finish.
- E. Latch and Lock Hardware:
 - 1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
 - 2. Keys: Furnish two keys per lock and key all locks alike.
 - 3. Mortise Cylinder Preparation: Where indicated, prepare door panel to accept cylinder specified in Section 087100 "Door Hardware."
- F. Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

2.5 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

2. Factory Finished: Apply manufacturer's standard baked-enamel or powder-coat finish immediately after cleaning and pretreating, with minimum dry-film thickness of 1 mil for topcoat.
 - a. Color: Match Architect's sample.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 083113

SECTION 08 33 23

OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manual overhead insulated coiling doors.

B. Related Requirements:

1. Section 05 50 00 "Metal Fabrications" for miscellaneous steel supports, door-opening framing, corner guards, and bollards.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.
5. Show locations of controls, locking devices and other accessories.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

1. Include similar Samples of accessories involving color selection.

D. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:

1. Curtain slats.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

- B. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
- A. Accessibility Standard: Comply with applicable provisions in the ABA standards of the Federal agency having jurisdiction and CCR Title 24.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of doors that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

- A. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance, Exterior Doors: Capable of withstanding the following design wind loads:
 - 1. Design Wind Load: As indicated on Drawings.
 - 2. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
- B. Seismic Performance: Overhead coiling doors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. Component Importance Factor: 1.0.
- C. Air Infiltration: Maximum rate of 0.4 cfm/sq. ft. when tested according to ASTM E 283.
- D. Insulated Door Slat Material Performance Requirements:
 - 1. Flame Spread Index of 0 and a Smoke Developed Index of 10 as tested per ASTM E84.

2. Sound Transmission Class (STC) rating up to 30 for the curtain and up to 22 for the entire assembly, as tested per ASTM E90 and based on testing a complete, operable assembly.
3. Minimum R-value of 8.0 (U-value of 0.125) as calculated using the ASHRAE Handbook of Fundamentals.
4. Insulation to be CFC Free with an Ozone Depletion Potential (ODP) rating of zero.

2.3 DOOR ASSEMBLY

- A. Insulated Coiling Door: Overhead coiling door formed with curtain of interlocking metal slats.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Model Number ESD30 Thermiser Max Insulated Rolling Door manufactured by Cookson Company, or comparable product by one of the following:
 - a. Cornell Iron Works, Inc.
 - b. Overhead Door Corporation.
 - c. Raynor.
- B. Operation Cycles: Door components and operators capable of operating for not less than 50,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
- C. Door Curtain Material: Galvanized steel.
- D. Door Curtain Slats: Flat profile slats of 2-5/8-inch center-to-center height.
 1. Insulated-Slat Interior Facing: Metal.
 2. Gasket Seal. Manufacturer's standard continuous gaskets between slats.
- E. Insulated Bottom Bar: Reinforced extruded aluminum interior face with full depth insulation and exterior skin slat to match curtain material and gauge. Minimum 4 inches high by 1-1/16 inches wide. Provide Air Infiltration Certification Label affixed to bottom bar.
- F. Thermal Break Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats.
- G. Hood: Match curtain material and finish.
 1. Shape: As indicated on Drawings.
 2. Mounting: As indicated on Drawings.
- H. Locking Devices: Equip door with slide bolt for padlock.
- I. Manual Door Operator: Wall-crank operator.
- J. Curtain Accessories: Equip door with weatherseals.
- K. Door Finish:
 1. Baked-Enamel or Powder-Coated Finish: ASTM A 653 galvanized base coating treated with dual process rinsing agents in preparation for chemical bonding, baked-on base coat and baked-on polyester finish coat.

a. Basis of Design: SpectraShield Coating System.

1) Color: As selected by Architect from manufacturer's full range.

L. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.4 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A 653/A 653M, with G90 zinc coating; nominal sheet thickness (coated) of 0.028 inch; and as required.
2. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84 or UL 723. Enclose insulation completely within slat faces.
3. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face, with minimum steel thickness of 0.010 inch and minimum aluminum thickness of 0.032 inch.

B. Thermal Break Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

2.5 HOODS

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

1. Galvanized Steel: Nominal 0.028-inch- thick, hot-dip galvanized steel sheet with G90 zinc coating, complying with ASTM A 653/A 653M.

2.6 LOCKING DEVICES

A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.

2.7 CURTAIN ACCESSORIES

A. Weatherseals for Exterior Doors: Equip each exterior door with weather-stripping gaskets fitted to entire exterior perimeter of door for a weather-resistant installation unless otherwise indicated.

1. At door head, use 1/8-inch- thick, replaceable, continuous-sheet baffle secured to inside of hood or field- installed on the header.
2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch- thick seals of flexible vinyl, rubber, or neoprene.

2.8 COUNTERBALANCING MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless or welded carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of parts and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.
- C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.9 MANUAL DOOR OPERATORS

- A. General: Equip door with manual door operator by door manufacturer.
- A. Crank Operator: Consisting of crank and crank gearbox, steel crank drive shaft, and gear-reduction unit, of type indicated. Size gears to require not more than 25-lbf force to turn crank. Fabricate gearbox to be oiltight and to completely enclose operating mechanism. Provide manufacturer's standard crank-locking device.

2.10 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.11 ALUMINUM FINISHES

- A. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Manufacturer's baked-on finish indicated. Comply with coating manufacturer's written instructions for cleaning, conversion coating, application, and minimum dry film thickness.

2.12 STEEL AND GALVANIZED-STEEL FINISHES

- A. Baked-Enamel or Powder-Coat Finish: Manufacturer's baked-on finish indicated. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.
- C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with the accessibility standard.

3.3 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
 - 1. Adjust exterior doors and components to be weather-resistant.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide tight fit around entire perimeter.

END OF SECTION 083323

SECTION 08 51 23

STEEL WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel windows from hot-rolled sections.
2. Steel windows from cold-formed steel members.

B. Related Sections:

1. Section 09 91 23 "Interior Painting" and Section 09 91 13 "Exterior Painting" for on-site painting of factory prime-coated windows.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide steel windows capable of withstanding the effects of the following loads and stresses within limits and under conditions indicated, based on testing windows that are representative of those specified according to ASTM E 330 or structural calculations:

1. Design Wind Loads: Determine design wind loads under conditions indicated according to ASCE/SEI 7.
2. Deflection Limits: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch, whichever is less, at design pressures.

B. Water Penetration: No leakage for 15 minutes when window is subjected to a rate of flow of 5 gal./h per sq. ft. with a differential pressure across the window of 2.86 lbf/sq. ft. when tested according to ASTM E 331.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles and finishes.

B. Shop Drawings: Include plans, elevations, sections, details, attachments to other work, installation details, and the following:

1. Joinery details.
2. Flashing and drainage details.
3. Glazing details.
4. Window-cleaning provisions.
5. Accessories.

- C. Samples for Verification: For steel windows and components required, prepared on Samples of size indicated below:
 - 1. Main Framing Member: 12-inch- long, full-sized sections, with glazing bead.
- D. Delegated-Design Submittal: For steel windows indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer capable of fabricating steel windows that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists, and by labels, test reports, and calculations.
- B. Installer Qualifications: An installer acceptable to window manufacturer for installation of units required for this Project.
 - 1. Installer's responsibilities include providing professional engineering services needed to assume engineering responsibility including preparation of data for steel windows, including Shop Drawings and Designated Design Submittal based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- C. Source Limitations: Obtain steel windows from single source from single manufacturer.
- D. Fire-Test-Response Characteristics: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated on Drawings, based on testing indicated.
 - 1. Positive-Pressure Test: UBC 7-4.
- E. SWI Publication: Comply with applicable requirements in SWI's "The Architect's Guide to Steel Windows and Doors" except where more stringent requirements are indicated.
- F. Preinstallation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of steel window openings by field measurements before fabrication.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of steel windows that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure to meet performance requirements.
 - b. Structural failures including excessive deflection.

- c. Water leakage or air infiltration.
 - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
- 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hot-Rolled Steel Windows:
 - a. A & S Window Associates, Inc.
 - b. Bliss Nor-Am Doors & Windows Ltd.
 - c. Clement Steel Windows Ltd.
 - d. Crittall Windows Ltd.
 - e. Hope's Windows, Inc.
 - f. Optimum Window Manufacturing Corp.
 - g. Torrance Steel Window Co., Inc.
 - 2. Cold-Formed Steel Windows:
 - a. D.V. Fyre-Tec, Inc.
 - b. Optimum Window Manufacturing Corp.

2.2 MATERIALS

- A. Fasteners: Provide fasteners of bronze, brass, stainless steel, or other metal that are warranted by manufacturer to be noncorrosive and compatible with trim, anchors, and other components of steel windows.
 - 1. Exposed Fasteners: If exposed fasteners are used, provide Phillips flat-head machined screws that match finish of member being fastened, as appropriate.
- B. Anchors, Clips, and Window Accessories: Provide units of stainless steel, hot-dip zinc-coated steel, bronze, brass, or iron complying with ASTM A 123/A 123M. Provide units with sufficient strength to withstand design pressure indicated.
- C. Glazing Stops: Manufacturer's standard.
- D. Sealant: For sealants required within fabricated windows, provide manufacturer's standard fire rated, permanently elastic, nonshrinking, and nonmigrating type recommended by sealant manufacturer for joint size and movement.

2.3 WINDOW

- A. Window Type: Fixed.

- B. Hot-Rolled Steel Window Members: Provide frame members formed from hot-rolled, new billet steel sections.

- 1. Window Finish: Galvanized and factory primed.

- C. Cold-Formed Steel Window Members: Provide frame members mechanically formed from metallic-coated, low-carbon, cold-rolled steel sheet complying with ASTM A 653/A 653M.

- 1. Window Finish: Galvanized and factory primed.

2.4 GLAZING

- A. Glass and Glazing System: Comply with Section 08 80 00 "Glazing" for insulating glass units for steel windows.

2.5 ACCESSORIES

- A. General: Provide manufacturer's standard accessories that comply with indicated standards.

- B. Window Cleaner Anchor Bolts: Provide window cleaner anchor bolts of standard design, complying with requirements of authorities having jurisdiction. Fabricate bolts of nonmagnetic stainless steel.

- 1. Reinforce window units or mullions to receive bolts and provide additional anchorage of units at bolt locations.

2.6 FABRICATION

- A. General: Fabricate steel windows of type and in sizes indicated to comply with SWI standards. Include a complete system for assembly of components and anchorage of window units.

- 1. Provide units that are reglazable without dismantling ventilator framing.
 - 2. Prepare window ventilators for factory glazing.

- B. Provide weep holes and internal water passages to conduct infiltrating water to the exterior.

- C. Glazing Stops: Provide screw-applied glazing stops; coordinate with Section 08800 "Glazing" and with glazing system indicated. Provide glazing stops to match panel frames. Finish glazing stops to match window units if fabricated of steel; otherwise, provide manufacturer's standard finish.

- D. Glazing Clips: Where face glazing (without glazing stops) is indicated, furnish glazing clips for concealment in glazing compound.

2.7 METALLIC-COATED STEEL SHEET FINISHES

- A. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and apply galvanizing repair paint complying with SSPC-Paint 20 and ASTM A 780.

- B. Factory Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Verify rough opening dimensions and levelness of sill plate. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight window installation.
 - 1. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches of opening.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing windows, accessories, and other components.
- B. Install windows level, plumb, square, true to line, without distortion or impediment to thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
- C. Set sill members in bed of sealant or with gaskets, as indicated, to provide weathertight construction.
- D. Install windows and components to drain condensation, water-penetrating joints, and moisture migrating within windows to the exterior.
- E. Separate corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials according to ASTM E 2112, Section 5.12 "Dissimilar Materials."

3.3 ADJUSTING, CLEANING, AND PROTECTION

- A. Clean factory-finished steel surfaces immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Avoid damaging protective coatings and finishes.
- B. Clean glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.
- C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

- D. Protect window surfaces from contact with contaminating substances resulting from construction operations. Remove contaminants immediately according to manufacturer's written recommendations.
- E. Refinish or replace windows with damaged finish.

END OF SECTION 085123

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Finish hardware except as otherwise specified or specifically omitted herein.
- B. Related Sections:
 - 1. Section 064116 Plastic-Laminate-Faced Architectural Cabinets.
 - 2. Section 081113 Hollow Metal Doors and Frames.
 - 3. Section 323113 Chain Link Fences and Gates.
- C. Specific Omissions: Hardware for the following is specified or indicated elsewhere.
 - 1. Windows.
 - 2. Cabinets and locks.
 - 3. Signs.
 - 4. Toilet accessories.
 - 5. Installation.
 - 6. Rough hardware.

1.2 REFERENCES

- A. Published specifications, standards, tests, or recommended methods of trade, industry, or governmental organizations apply to Work of this Section where cited by abbreviations noted below (latest editions apply unless noted otherwise).
- B. ADA - Americans with Disabilities Act Standards for Accessible Design.
- C. ANSI - American National Standards Institute.
- D. BHMA - Builders Hardware Manufacturers Association.
- E. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.
- F. DSA - Division of the State Architect.
- G. NFPA 80 - Fire Doors and Windows.
- H. UL - Underwriters Laboratories.

1.3 SUBSTITUTIONS & SUBMITTALS

- A. Requests for substitutions must be made in writing 10 days prior to bid date to allow architect to issue an addendum. If proposing a substitute, submit that product data attached to one showing specified item and indicate savings to be made. Provide sample if requested. No other substitutions will be allowed.
 - 1. Items listed with no substitute manufacturers have been requested by the Owner to match existing.
- B. Submit six copies of schedule within 4 weeks after project has been awarded. Organize schedule into "Hardware Sets" with an index of doors and heading, indicating complete designations of every item required for each door or opening. Include the following information:
 - 1. Type, style, function, size, quantity and finish of each hardware item. Use BHMA inish codes as per ANSI A156.18.
 - 2. Name, part number and manufacturer of each item.

3. Fastenings and other pertinent information.
4. Location of hardware set cross referenced to indications on drawings both on floor plans and in door schedule.
5. Explanation of all abbreviations, symbols, and codes contained in schedule.
6. Mounting locations for hardware.
7. Door and frame sizes and materials.

1.4 QUALITY ASSURANCE

- A. Qualifications:
 1. Obtain each kind of hardware (latch and lock sets, exit devices, hinges, and closers) from only one manufacture, although several may be indicated as offering products complying with requirements.
 2. Hardware supplier shall be a direct factory contract supplier who has in his employment a certified hardware consultant (AHC) who is available at all reasonable times during the course of the work for project hardware consultation to the District, Architect, and Contractor.
- B. Schedule Designations: Except as otherwise indicated, the use of one manufacturer's numeric designation system in schedules does not imply that another manufacturer's products will not be acceptable, unless they are not equal in design, size, weight, finish, function, or other quality of significance. See 1.3 A for substitutions.

1.5 REGULATORY REQUIREMENTS

- A. Fire-Rated Openings: Comply with CBC Section 716 and NFPA No. 80. Provide only hardware tested and listed by UL for the type and size of each door required, which complies with the requirements of the door and frame labels.
 1. Where exit devices are required on fire rated doors, provide supplementary marking on door UL label indicating "Fire Door to be Equipped with Fire Exit Hardware", and provide UL label on exit device indicating "Fire Exit Hardware".
- B. Conform to applicable requirements of the Americans with Disabilities Act Standards for Accessible Design regarding accessibility requirements for door and entrance hardware.
- C. Doors and doorways that are part of an accessible route shall meet the requirements of CBC Sections 1010.1.7, 1010.1.8, 1010.1.9, 11B-309.4, and 11B-404.
- D. The clear opening width for a door shall be 32 inches minimum. For a swinging door it shall be measured between the face of the door and the stop, with the door open 90 degrees. There shall be no projections into the opening below 34 inches and 4 inches maximum projections into the opening between 34 inches and 80 inches above the finish floor or ground. Door closers and stops shall be permitted to be 78 inches minimum above the finish floor or ground. CBC Section 11B-404.2.3 and 1010.1.1.
 1. Exception: doors not requiring full passage through the opening, that is, to spaces less than 24 inches in depth, may have the clear opening width reduced to 20 inches.
- E. Handles, pulls, latches, locks, and other operable parts on accessible doors shall comply with CBC Section 11B-309.4 and be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. Operable parts of such hardware shall be 34 inches minimum and 44 inches maximum above the finish floor or ground. Where sliding doors are in the fully open position, operating hardware shall be exposed and usable from both sides. CBC Section 11B-404.2.7.
- F. The force for pushing or pulling open a door shall be as follows: CBC Section 11B-404.2.9 and 1010.1.3.
 1. Interior hinged doors, sliding or folding doors, and exterior hinged doors: 5 lbs. (22.2N) maximum.
 2. Required fire doors: the minimum opening force allowable by the DSA Authority, not to exceed 15 lbs. (67N) maximum.

3. The force required to activate any operable parts, such as retracting latch bolts or disengaging other devices shall be 5 lbs. (22.2N) maximum to comply with CBC Section 11B-309.4.
- G. Door closing speeds shall be as follows: CBC Section 11B-404.2.8.1.
 1. Closer shall be adjusted so that the required time to move a door from an open position of 90 degrees to a position of 12 degrees from the latch is 5 seconds minimum.
 2. Spring hinges shall be adjusted so that the required time to move a door from an open position of 70 degrees to the closed position is 1.5 seconds minimum.
 - H. Provide doors with smooth surfaces at the bottom 10 inches of push sides of doors, facilitating push-open with wheelchair footrests. CBC Section 11B-404.2.10.
 - I. Thresholds shall comply with CBC Section 11B-404.2.5 and 1010.1.7.
 - J. Floor stops shall not be located in the path of travel and 4 inches maximum from walls, per CBC 11B-204 and 11B-307.
 - K. Hardware (including exit devices) shall not be provided with "Night Latch" (NL) function for any accessible doors or gates unless the following conditions are met per DSA Interpretation 10-08 DSA /AC (External), revised 4/28/09. Such conditions must be clearly demonstrated and indicated in the specifications:
 1. Such hardware has a 'dogging' feature.
 2. It is dogged during the time the facility is open.
 3. Such 'dogging' operation is performed only by employees as their job function (non-public use).
 - L. Pair of doors: Limit swing of one leaf to 90 degrees so that a clear floor space is provided beyond the arc of the swing for the wall-mounted tactile sign. CBC Section 11B-703.4.2.1.
 - M. Exit device shall be compliant with State Fire Marshall Standard 12-10-3, Section 12-10-302.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Acceptance at Site: Individually package each unit of finish hardware complete with proper fastening and appurtenances, clearly marked on the outside to indicate contents and specific locations in the Work.
- B. Deliver packaged hardware items at the times and to the locations (shop or field) for installation, as directed by the Contractor.

1.7 PROJECT CONDITIONS

- A. Coordination: Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents.
- B. Upon request, check the Shop Drawings for doors and entrances to confirm that adequate provisions will be made for the proper installation of hardware.

1.8 WARRANTY

- A. Provide guarantee from hardware supplier as follows:
 1. Closers: Five years, except electronic closers, two years.
 2. Exit Devices: Two years.
 3. All other Hardware: Two years.

PART 2 - MATERIALS

2.1 MANUFACTURERS

- A. Approval of manufacturers other than those listed shall be in accordance with paragraph 1.3 A.

<u>Item:</u>	<u>Manufacturer:</u>	<u>Acceptable Substitute:</u>
Butt Hinges	Ives	McKinney, Bommer
Continuous Hinges	Ives	McKinney, Select
Locksets	Schlage	Owners standard
Cylinders	Schlage	Owners standard
Exit Devices	Von Duprin	Owners standard
Surface Closers	LCN	Owners standard
Anti Vandal Pulls	Ives	Rockwood, Trimco
Kick Plates	Ives	Rockwood, Trimco
Door Stops	Ives	Rockwood, Trimco
Silencers	Ives	Rockwood, Trimco
Overhead Stops	Glynn Johnson	Rixson, ABH
Gate Pivots	Bommer	McKinney
Security Key Boxes	Knox	As specified
Thresholds/Sweeps/Seals	Pemko	Reese, NGP

- B. Furnish items of hardware required to complete the work in accordance with these specifications and the manufacturers' instructions. Items of hardware not specified shall be provided even though inadvertently omitted from this specification. Items shall be of equal quality and type.
- C. Where the exact types of hardware specified are not adaptable to the finished shape or size of the members requiring hardware, furnish suitable types having as nearly as practicable the same operation and quality as the type specified, subject to Architect's approval.

2.2 MATERIALS

- A. Locksets: Locksets and latchsets shall be as specified. Strikes shall be 16 gage curved steel, bronze or brass with 1" deep box construction, and have lips of sufficient length to clear trim and protect clothing.
1. Comply with requirements of local security ordinances.
 2. Provide approved fusible links at levers for labeled doors.
 3. Lock Series and Design: Schlage L series Omega lever.
- B. Butt Hinges: Outswinging exterior doors shall have nonremovable (NRP) pin. Hinge open widths shall be minimum, but of sufficient size to permit door to swing 180 degrees.
1. Furnish 3 hinges per leaf to 7 foot, 6 inch height. Add one for each additional 30 inches in height or fraction thereof.
 2. Provide 5 inch heavy weight hinges on doors over 3 feet, 5 inches width.
- C. Continuous Hinges: Hinge open widths shall be minimum, but of sufficient size to permit door to swing 180 degrees. Where necessary to maintain door clearance at jamb trim, frame conditions, door reveals, and similar conditions, furnish wide throw hinges as approved by the Architect. Where door is indicated as having fire resistance rating, provide UL listed and labeled hardware.
- D. Exit Devices: Furnish devices at doors with thru-bolts unless otherwise specified. Lever handle trim shall match locksets.
1. Provide glass bead kits of proper thickness where the rail assembly of the exit device crosses a lite.

- E. Surface Door Closers: Full rack and pinion type with removable non-ferrous case. Provide closers with Thru-bolts at doors. Place closers inside building, stairs, and rooms. Closers shall be non-handed, non-sized, and installed to permit door to swing 180 degrees.
 - 1. Flush transom offset brackets shall be used where parallel arm closers are listed for doors with fixed panels over.
 - 2. Provide drop plates, shoe supports, and blade stop spacers as required at narrow top rails
- F. Protection Plates: Provide kick, armor, or mop plates with four beveled edges, .050 inches minimum thickness, height called for in schedule by width less 2-inches. Furnish with machine or wood screws of bronze or stainless steel to match other hardware.
- G. Floor Stops: Floor mounted door stops are prohibited where located in the path of travel. Where provided, install maximum 4 inches from wall surface.
- H. Seals: Seals shall be finished to match adjacent frame color. UL label shall be applied on all rated doors.
- I. Screws: Exposed screws shall be Phillips head. Do not use self-drilling, self-tapping screws, unless furnished by hardware manufacturer for the specific condition or for mounting flat-goods such as push plates and kick plates.
- J. Silencers: Furnish silencers for interior hollow metal frames, 3 for single doors, 2 for pairs of doors.
- K. Thresholds: Change in level between 1/4 inch and 1/2 inch shall be beveled with a slope no greater than 1 unit vertical to 2 units horizontal (50 percent slope). The floor or landing shall not be more than 1/2 inch lower than the threshold of the doorway.

2.3 FINISH

- A. Generally to be BHMA 626 Satin Chromium.
 - 1. Areas using BHMA 626 shall have push, pulls and kick plates of BHMA 630, Satin Stainless Steel, unless otherwise noted.
- B. Factory paint door closers to match other hardware, unless otherwise noted.
- C. Aluminum items shall be finished to match predominant adjacent material. Seals to coordinate with frame color.

2.4 KEYING REQUIREMENTS

- A. Contact the District Locksmith with Grossmont Union High School District (619-644-8167) for keying requirements. Keying system shall be coordinated with the District and approved by District's representative in writing. Furnish construction key system in accordance with lock manufacturers' standard. Where interchangeable core systems are used, provide temporary cores for construction keying.
 - 1. Key system shall be Schlage Everest Primus, Level 9G keyway, I/C core cylinder.
- B. For protection of the District, key cylinders at the factory of the cylinder manufacturer where permanent records are maintained. Permanently inscribe each key with number that identifies cylinder manufacturer key symbol, and notation "DO NOT DUPLICATE".
- C. Key Quantity: Furnish 10 construction keys; 2 construction control keys; 200 key blanks and 10 control key blanks; 4 keys per core and 20 extra 0-bitted cylinder cores. Permanent keys and cylinder cores shall be delivered only to District's representative.
- D. Keying Schedule: Submit three copies of separate detailed schedule indicating clearly how the District's final instructions on keying of locks have been fulfilled.

PART 3 - EXECUTION

3.1 HARDWARE LOCATIONS

- A. Lockset: 34 to 44 inches above finished floor. Verify manufacturers' template with door design.
- B. Exit Device: 36 to 44 inches above finished floor. Verify manufacturers' template with door design.
- C. Floor Stop: Installed at a maximum of 4 inches from the face of the wall or partition.
- D. Conform to CCR, Title 24, Part 2, and ADA for positioning requirements for accessibility.

3.2 INSTALLATION

- A. Pre-Installation Meetings: Initiate and conduct with supplier, installer, and related trades, coordinate materials and techniques, and sequence complex hardware items and systems installation. Include manufacturers' representatives of locks, panic hardware, and door closers in the meetings.
- B. Install each hardware item per manufacturer's instructions and recommendations. Do not install surface mounted items until finishes have been completed on the substrate. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- C. Set exterior door thresholds with full-width bead of elastomeric sealant on each point of contact with floor providing a continuous weather seal. Anchor thresholds with stainless steel countersunk screws.

3.3 ADJUSTING

- 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.
- B. Inspection: Hardware supplier shall inspect hardware furnished within 10 days of contractors request and include with his guarantee a statement that this has been accomplished. Inspector or Contractor will sign off the hardware as being complete and correctly installed and adjusted. Further corrections of defective material shall be the responsibility of his representative.

3.4 SCHEDULE OF DOOR HARDWARE

- A. Legend of listed manufacturers:

BOM	Bommer
GLY	Glynn Johnson
IVE	Ives
KNX	Knox
LCN	LCN
NGP	National Guard Products
SCH	Schlage
VON	Von Duprin

- B. The last column in the Hardware Schedule refers to the manufacturer listed above.
- C. The Door Schedule on the Drawings indicates which Hardware Set is used with each door.
- D. Schedule of Door Hardware:

HW-1

Each door to have

1	CONTINUOUS HINGE	224HD	628	IVE
1	LOCKSET	LV9071T x OME x L283-711	626	SCH
2	PERMANENT CORE	20-740	626	SCH
1	LOCK ASTRAGAL	LG12	630	IVE
1	SURFACE CLOSER	4040XP-HEDA x ST1944	689	LCN
1	KICK PLATE	8400 - 10 x 2 LDW x B4E	630	IVE
1	FLOOR STOP	FS18S	626	IVE
1 SET	DOOR SEALS	703V HEAD & JAMBS	628	NGP
1	DOOR SWEEP	96V	628	NGP
1	THRESHOLD	PER SILL DETAIL	628	NGP

Note: Install door seals before closer

HW-2

Each opening to have

1	PADLOCK	KS43F3200	606	SCH
1	PERMANENT CORE	20-740	606	SCH

Note: Balance of material provided by Overhead Roll-Up Door Manufacturer

HW-3

Each pair gate to have

1	PADLOCK	KS43F3200	606	SCH
1	PERMANENT CORE	20-740	606	SCH

Note: Balance of material provided by Gate Manufacturer

HW-4

Each door to have

1	CONTINUOUS HINGE	224HD	628	IVE
1	LOCKSET	LV9071T x OME x L283-711	626	SCH
2	PERMANENT CORE	20-740	626	SCH
1	LOCK ASTRAGAL	LG12	630	IVE
1	SURFACE CLOSER	4040XP-SHCUSH x ST1595	689	LCN
1	KICK PLATE	8400 - 10 x 2 LDW x B4E	630	IVE
1 SET	DOOR SEALS	703V HEAD & JAMBS	628	NGP
1	DOOR SWEEP	96V	628	NGP
1	THRESHOLD	PER SILL DETAIL	628	NGP

Note: Install door seals before closer

HW-5

Each gate to have

1	PADLOCK	KS43F3200	606	SCH
1	PERMANENT CORE	20-740	606	SCH

Note: Balance of material provided by Gate Manufacturer

HW-6

Each door to have

1	CONTINUOUS HINGE	224HD	628	IVE
1	LOCKSET	LV9080T x OME	626	SCH
1	PERMANENT CORE	20-740	626	SCH
1	LOCK ASTRAGAL	LG12	630	IVE
1	KICK PLATE	8400 - 10 x 2 LDW x B4E	630	IVE
1	OVERHEAD STOP	900F	630	GLY
1 SET	DOOR SEALS	703V HEAD & JAMBS	628	NGP
1	DOOR SWEEP	96V	628	NGP
1	THRESHOLD	PER SILL DETAIL	628	NGP
Note: Install door seals before overhead stop				

HW-7

Each door to have

1	CONTINUOUS HINGE	224HD	628	IVE
1	LOCKSET	LV9070T x OME	626	SCH
1	PERMANENT CORE	20-740	626	SCH
1	LOCK ASTRAGAL	LG12	630	IVE
1	SURFACE CLOSER	4040XP-SCUSH x ST1595	689	LCN
1	KICK PLATE	8400 - 10 x 2 LDW x B4E	630	IVE
1 SET	DOOR SEALS	703V HEAD & JAMBS	628	NGP
1	DOOR SWEEP	96V	628	NGP
1	THRESHOLD	PER SILL DETAIL	628	NGP

Note: Install door seals before closer

HW-8

Each door to have

1	CONTINUOUS HINGE	224HD	628	IVE
1	LOCKSET	LV9485T x OME x L583-363 x L283-722	626	SCH
1	PERMANENT CORE	30-120	626	SCH
1	LOCK ASTRAGAL	LG12	630	IVE
1	SURFACE CLOSER	4040XP-SCUSH x ST1595	689	LCN
1	KICK PLATE	8400 - 10 x 2 LDW x B4E	630	IVE
1	COAT HOOK	405	626	IVE
1 SET	DOOR SEALS	703V HEAD & JAMBS	628	NGP
1	DOOR SWEEP	96V	628	NGP
1	THRESHOLD	PER SILL DETAIL	628	NGP

Note: Install door seals before closer

HW-9

Each door to have

1	CONTINUOUS HINGE	224HD	628	IVE
1	LOCKSET	LV9070T x OME	626	SCH
1	PERMANENT CORE	20-740	626	SCH
1	LOCK ASTRAGAL	LG12	630	IVE
1	KICK PLATE	8400 - 10 x 2 LDW x B4E	630	IVE
1	OVERHEAD STOP	900F	630	GLY
1 SET	DOOR SEALS	703V HEAD & JAMBS	628	NGP
1	DOOR SWEEP	96V	628	NGP
1	THRESHOLD	PER SILL DETAIL	628	NGP

Note: Install door seals before overhead stop

HW-10

Each door to have

1	CONTINUOUS HINGE	224HD	628	IVE
1	EXIT DEVICE	AX-PA-XP-CDSI-99NL-OP x 110NL	626	VON
1	MORTISE CYLINDER	20-061-ICX	626	SCH
1	RIM CYLINDER	20-057-ICX	626	SCH
2	PERMANENT CORE	20-740	626	SCH
1	ANTI VANDAL PULL	VR910NL	630	IVE
1	SURFACE CLOSER	4040XP-HEDA x ST1944	689	LCN
1	KICK PLATE	8400 - 10 x 2 LDW x B4E	630	IVE
1	FLOOR STOP	FS18S	626	IVE
1 SET	DOOR SEALS	703V HEAD & JAMBS	628	NGP
1	DOOR SWEEP	96V	628	NGP
1	THRESHOLD	PER SILL DETAIL	628	NGP

Note: Install door seals before closer and rim strike

Note: Adjust exit device backset to allow for jamb seal

HW-11

Each door to have

3	HINGE	3CB1 - 4.5 x 4.5	652	IVE
1	EXIT DEVICE	AX-PA-XP-CDSI-99L x 996L-OME	626	VON
1	MORTISE CYLINDER	20-061-ICX	626	SCH
1	RIM CYLINDER	20-057-ICX	626	SCH
2	PERMANENT CORE	20-740	626	SCH
1	SURFACE CLOSER	4040XP-HEDA	689	LCN
1	KICK PLATE	8400 - 10 x 2 LDW x B4E	630	IVE
1	WALL BUMPER	WS402CVX	630	IVE
3	SILENCERS	SR64	GRY	IVE

HW-12

Each opening to have

2	MORTISE CYLINDER	20-061-ICX	626	SCH
2	PERMANENT CORE	20-740	626	SCH

Note: Balance of material provided by Sliding Glass Door Manufacturer

HW-13

Each door to have

3	HINGE	3CB1 - 4.5 x 4.5	652	IVE
1	LOCKSET	L9071T x OME x L283-711	626	SCH
2	PERMANENT CORE	20-740	626	SCH
1	SURFACE CLOSER	4040XP-H	689	LCN
1	KICK PLATE	8400 - 10 x 2 LDW x B4E	630	IVE
1	FLOOR STOP	FS436	626	IVE
3	SILENCERS	SR64	GRY	IVE

HW-14

Each door to have

1	CONTINUOUS HINGE	224HD	628	IVE
1	EXIT DEVICE	AX-PA-XP-CDSI-99NL-OP x 110NL	626	VON
1	MORTISE CYLINDER	20-061-ICX	626	SCH
1	RIM CYLINDER	20-057-ICX	626	SCH
2	PERMANENT CORE	20-740	626	SCH
1	ANTI VANDAL PULL	VR910NL	630	IVE
1	SURFACE CLOSER	4040XP-SHCUSH x ST1595	689	LCN
1	KICK PLATE	8400 - 10 x 2 LDW x B4E	630	IVE
1 SET	DOOR SEALS	703V HEAD & JAMBS	628	NGP
1	DOOR SWEEP	96V	628	NGP
1	THRESHOLD	PER SILL DETAIL	628	NGP

Note: Install door seals before closer and rim strike

Note: Adjust exit device backset to allow for jamb seal

HW-15

Each door to have

1 SET	GATE PIVOT	7122	626	BOM
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HW-16

Each door to have

3	HINGE	3CB1 - 4.5 x 4.5	652	IVE
1	LOCKSET	L9456T x OME x L583-363 x L283-722	626	SCH
1	PERMANENT CORE	20-740	626	SCH
1	SURFACE CLOSER	4040XP-REG	689	LCN
1	KICK PLATE	8400 - 10 x 2 LDW x B4E	630	IVE
1	MOP PLATE	8400 - 6 x 1 LDW x B4E	630	IVE
1	WALL BUMPER	WS402CVX	630	IVE
1	COAT HOOK	405	626	IVE
3	SILENCERS	SR64	GRY	IVE

HW-17

Each door to have

3	HINGE	3CB1 - 4.5 x 4.5	652	IVE
1	LOCKSET	L9070T x OME	626	SCH
1	PERMANENT CORE	20-740	626	SCH
1	KICK PLATE	8400 - 10 x 2 LDW x B4E	630	IVE
1	OVERHEAD STOP	900S	630	GLY
3	SILENCERS	SR64	GRY	IVE

HW-18

Each rolling gate to have

1	PADLOCK	KS43F3200	606	SCH
1	PERMANENT CORE	20-740	606	SCH
1	SECURITY KEY BOX	3261	BLK	KNX

Note: Balance of material provided by Gate Manufacturer

HW-19

Each door to have

3	HINGE	3CB1 - 4.5 x 4.5	652	IVE
1	LOCKSET	L9070T x OME	626	SCH
1	PERMANENT CORE	20-740	626	SCH
1	KICK PLATE	8400 - 10 x 2 LDW x B4E	630	IVE
1	FLOOR STOP	FS436	626	IVE
3	SILENCERS	SR64	GRY	IVE

HW-20

Each pair to have

2	CONTINUOUS HINGE	224HD	628	IVE
1	REMOVABLE MULLION	KR4954 x MT54	689	VON
1	EXIT DEVICE	AX-PA-XP-CDSI-99NL-OP x 110NL	626	VON
1	EXIT DEVICE	AX-PA-XP-CDSI-99EO	626	VON
3	MORTISE CYLINDER	20-061-ICX	626	SCH
1	RIM CYLINDER	20-057-ICX	626	SCH
4	PERMANENT CORE	20-740	626	SCH
1	ANTI VANDAL PULL	VR910NL	630	IVE
1	ANTI VANDAL PULL	VR910DT	630	IVE
2	SURFACE CLOSER	4040XP-SHCUSH x ST1595	689	LCN
2	KICK PLATE	8400 - 10 x 2 LDW x B4E	630	IVE
1	MULLION SEAL	5100S	BLK	NGP
1 SET	DOOR SEALS	703V HEAD & JAMBS	628	NGP
2	DOOR SWEEP	96V	628	NGP
1	THRESHOLD	PER SILL DETAIL	628	NGP

Note: Install door seals before closer

HW-21

Each door to have

3	HINGE	3CB1 - 4.5 x 4.5	652	IVE
1	LOCKSET	L9071T x OME x L283-711	626	SCH
2	PERMANENT CORE	20-740	626	SCH
1	SURFACE CLOSER	4040XP-H	689	LCN
1	KICK PLATE	8400 - 10 x 2 LDW x B4E	630	IVE
1	FLOOR STOP	FS436	626	IVE
3	SILENCERS	SR64	GRY	IVE

Note: Field verify existing door and frame size and hardware preps

Note: Rework existing door and frame as required for new hardware

HW-22

Each door to have

3	HINGE	3CB1 - 4.5 x 4.5	652	IVE
1	LOCKSET	L9456T x OME x L583-363 x L283-722	626	SCH
1	PERMANENT CORE	20-740	626	SCH
1	SURFACE CLOSER	4040XP-REG	689	LCN
1	KICK PLATE	8400 - 10 x 2 LDW x B4E	630	IVE

1	MOP PLATE	8400 - 6 x 1 LDW x B4E	630	IVE
1	WALL BUMPER	WS402CVX	630	IVE
1	COAT HOOK	405	626	IVE
3	SILENCERS	SR64	GRY	IVE

Note: Field verify existing door and frame size and hardware preps

Note: Rework existing door and frame as required for new hardware

HW-23

Each door to have

3	HINGE	3CB1 - 4.5 x 4.5	652	IVE
1	LOCKSET	L9070T x OME	626	SCH
1	PERMANENT CORE	20-740	626	SCH
1	KICK PLATE	8400 - 10 x 2 LDW x B4E	630	IVE
1	OVERHEAD STOP	900S	630	GLY
3	SILENCERS	SR64	GRY	IVE

Note: Field verify existing door and frame size and hardware preps

Note: Rework existing door and frame as required for new hardware

HW-24

Each rolling gate to have

1	PADLOCK	KS43F3200	606	SCH
1	PERMANENT CORE	20-740	606	SCH

Note: Balance of material provided by Gate Manufacturer

END OF SECTION 087100

SECTION 08 80 00

GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Glass for sliding doors.
2. Glazing sealants and accessories.

1.2 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. IBC: International Building Code.
- D. Interspace: Space between lites of an insulating-glass unit.

1.3 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 2. Review temporary protection requirements for glazing during and after installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Glass Samples: For each type of glass product other than monolithic vision glass; 12 inches square.
- C. Glazing Accessory Samples: For gaskets and sealants, in 12-inch lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system.

- A. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- B. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installer and manufacturer of insulating-glass units with sputter-coated, low-E coatings.
- B. Product Certificates: For glass.
- C. Product Test Reports: For tinted glass, coated glass and insulating glass, for tests performed by a qualified testing agency.
- D. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved by coated-glass manufacturer.
- B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

- B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Glass Product: Subject to compliance with requirements, provide product indicated in glass schedules or comparable product by one of the following:
1. Guardian Industries Corp.
 2. Oldcastle BuildingEnvelope.
 3. Pilkington North America Inc.
 4. PPG Industries, Inc.
 5. Viracon, Inc.
- B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
1. Obtain tinted glass from single source from single manufacturer.
 2. Obtain reflective-coated glass from single source from single manufacturer.
- C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.
- C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.
1. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.
 - a. Basic Wind Speed: As indicated.
 - b. Importance Factor: As indicated.
 - c. Exposure Category: As indicated.

2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
 3. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
1. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
 2. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 3. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
 2. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
 3. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
1. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.
- E. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

2.4 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.
- B. Tinted Annealed Float Glass: ASTM C 1036, Type I, Class 2 (tinted), Quality-Q3.
- C. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- D. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- E. Reflective-Coated Vision Glass: ASTM C 1376, coated by vacuum deposition (sputter-coating) process.

2.5 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.
 - 1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
 - 2. Spacer: Manufacturer's standard spacer material and construction.

2.6 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
 - 1. EPDM complying with ASTM C 864.
 - 2. Silicone complying with ASTM C 1115.
 - 3. Thermoplastic polyolefin rubber complying with ASTM C 1115.
- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned EPDM, silicone, or thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.
 - 1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

2.7 GLAZING SEALANTS

- A. General:

1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Sealants used inside the weatherproofing system, shall have a VOC content of not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

2.8 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
 1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.9 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

2.10 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product

manufacturer and referenced glazing publications, to comply with system performance requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep systems.
 - 3. Minimum required face and edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and

- glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.

3.8 MONOLITHIC-GLASS SCHEDULE

- 1. As indicated on Drawings.

3.9 INSULATING-GLASS SCHEUDLE

- 1. As indicated on Drawings.

END OF SECTION 088000

SECTION 08 91 19

FIXED LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fixed, formed-metal louvers.

B. Related Requirements:

1. Section 08 11 13 "Hollow Metal Doors and Frames" for louvers in hollow-metal doors.

1.2 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades (i.e., the axes of the blades are horizontal).
- C. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
2. Show mullion profiles and locations.

C. Samples: For each type of metal finish required.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

- B. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

1. Wind Loads: Determine loads based on pressures as indicated on Drawings.

- B. Seismic Performance: Louvers, including attachments to other construction, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Design earthquake spectral response acceleration, short period (Sds) for Project is: As indicated on Drawings.
2. Component Importance Factor: 1.0.

- C. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

- D. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.3 FIXED, FORMED-METAL LOUVERS

- A. Horizontal, Drainable-Blade Louver:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Airolite Company, LLC (The).
 - b. Construction Specialties, Inc.
 - c. Ruskin Company; Tomkins PLC.
1. Louver Depth: As indicated on Drawings.
2. Frame and Blade Material and Nominal Thickness: Galvanized-steel sheet, not less than 0.052 inch.
3. Louver Performance Ratings: As indicated on Drawings.

2.4 MATERIALS

- A. Galvanized-Steel Sheet: ASTM A 653/A 653M, G60 zinc coating, mill phosphatized.
- B. Fasteners: Use types and sizes to suit unit installation conditions.
 1. Use Phillips flat-head tamper-resistant screws for exposed fasteners unless otherwise indicated.
 2. For fastening galvanized steel, use hot-dip-galvanized steel or 300 series stainless-steel fasteners.
 3. For color-finished louvers, use fasteners with heads that match color of louvers.
 4. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed for masonry, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 FABRICATION

- A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.
- C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
 1. Frame Type: As indicated.
- D. Include supports, anchorages, and accessories required for complete assembly including anchor brackets and sill flashing as recommended by manufacturer.
- E. Join frame members to each other and to fixed louver blades with fillet welds concealed from view, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.6 GALVANIZED-STEEL SHEET FINISHES

- A. Finish louvers after assembly.
- B. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating compatible with the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and repair according to ASTM A 780.
- C. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 2 mils.
 - 1. Color and Gloss: Match Architect's sample.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- F. Install concealed gaskets, flashing and joint fillers as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

- A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 089119

SECTION 09 22 16

NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.

B. Related Requirements:

1. Section 05 40 00 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses.

1.2 ACTION SUBMITTALS

- ###### A. Product Data:
- For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- ###### A. Evaluation Reports:
- For firestop tracks, from ICC-ES.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- ###### A. Fire-Test-Response Characteristics:
- For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.
-
- ###### B. STC-Rated Assemblies:
- For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 FRAMING SYSTEMS

- ###### A. Framing Members, General:
- Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
2. Protective Coating: Coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.

- B. Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners.
1. Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: As indicated on Drawings.
 - b. Depth: As indicated on Drawings.
 2. Dimpled Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: As indicated on Drawings.
 - b. Depth: As indicated on Drawings.
- C. Slip-Type Head Joints: Where indicated, provide the following:
1. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Dietrich Metal Framing; SLP-TRK Slotted Deflection Track.
 - 2) Steel Network Inc. (The); VertiClip SLD or VertiTrack VTD Series.
 - 3) Superior Metal Trim; Superior Flex Track System (SFT).
- D. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Fire Trak Corp.; Fire Trak System attached to studs with Fire Trak Posi Klip.
 - b. Grace Construction Products; FlameSafe FlowTrak System.
 - c. Metal-Lite, Inc.; The System.
 - d. Steel Network Inc. (The); VertiTrack VTD Series.
- E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
1. Minimum Base-Metal Thickness: As indicated on Drawings.
- F. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch- wide flanges.
1. Depth: As indicated on Drawings.
 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.
- G. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
1. Minimum Base-Metal Thickness: As indicated on Drawings.
 2. Depth: As indicated on Drawings.
- H. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.

1. Configuration: Asymmetrical or hat shaped.
- I. Cold-Rolled Furring Channels: 0.053-inch (16 gage minimum) uncoated-steel thickness, with minimum 1/2-inch- wide flanges.
 1. Depth: As indicated on Drawings.
 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch.
 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.
 - J. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-metal thickness of 0.018 inch, and depth required to fit insulation thickness indicated.

2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 9 gage wire, or double strand of 0.048-inch- diameter wire.
- A. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- B. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.
- C. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch and minimum 1/2-inch- wide flanges.
 1. Depth: As indicated on Drawings.
- D. Furring Channels (Furring Members):
 1. Cold-Rolled Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch wide flanges, 3/4 inch deep.
 2. Steel Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners of equivalent minimum base-metal thickness.
 - a. Minimum Base-Metal Thickness: As indicated on Drawings.
 - b. Depth: As indicated on Drawings.
 3. Dimpled Steel Studs and Runners: ASTM C 645.
 - a. Minimum Base-Metal Thickness: As indicated on Drawings.
 - b. Depth: As indicated on Drawings.
 4. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep, as indicated on Drawings.
 - a. Minimum Base-Metal Thickness: As indicated on Drawings.
 5. Resilient Furring Channels: 1/2-inch- deep members designed to reduce sound transmission.
 - a. Configuration: Asymmetrical or hat shaped.

- E. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

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

- a. Armstrong World Industries, Inc.; Drywall Grid Systems.
 - b. Chicago Metallic Corporation; Drywall Grid System.
 - c. USG Corporation; Drywall Suspension System.

2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.

- 1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

- B. Isolation Strip at Exterior Walls: Provide one of the following:

- 1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
 - 2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
 - 1. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
 - 2. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
 - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - a. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - b. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 - 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 - 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
 - 6. Curved Partitions:
 - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
 - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.

E. Direct Furring:

1. Screw to wood framing.
2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

F. Z-Furring Members:

1. Erect insulation, specified in Section 072100 "Thermal Insulation," vertically and hold in place with Z-furring members spaced 24 inches o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
3. Wire Hangers: Secure as indicated on Drawings.
4. Flat Hangers: Secure as indicated on Drawings.
5. Do not attach hangers to steel roof deck.
6. Do not attach hangers to permanent metal forms.
7. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

A. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

- B. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- A. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

SECTION 09 24 00

CEMENT PLASTERING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior vertical plasterwork (stucco).
2. Exterior horizontal and nonvertical plasterwork (stucco).

1.2 PREINSTALLATION MEETINGS

- ###### A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- ###### A. Product Data: For each type of product.
- ###### B. Shop Drawings: Show locations and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other work.
- ###### C. Samples for Verification: For finish coat indicated; 12 by 12 inches, and prepared on rigid backing.

1.4 QUALITY ASSURANCE

- ###### A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
1. Build mockups for each substrate and finish texture indicated for cement plastering, including accessories.
 - a. Size: 100 sq. ft. in surface area.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

- ###### A. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

1.6 PROJECT CONDITIONS

- A. Comply with ASTM C 926 requirements.
- B. Exterior Plasterwork:
 - 1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
 - 2. Apply plaster when ambient temperature is greater than 40 deg F.
 - 3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.

PART 2 - PRODUCTS

2.1 METAL LATH

- A. Wire-Fabric Lath:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Davis Wire Corporation; a Heico Wire Group company.
 - b. Jaenson Shepard Wire Company, Inc.
 - c. Keystone Steel & Wire Co.
 - d. K-Lath Building Products; a division of Georgetown Wire.
 - 2. Welded-Wire Lath: ASTM C 933; self-furring, 1.95 lb/sq. yd.
 - 3. Woven-Wire Lath: ASTM C 1032; self-furring, with stiffener wire backing, 1.4 lb/sq. yd.
- B. Paper Backing: FS UU-B-790a, Type I, Grade D, Style 2 vapor-permeable paper.

2.2 ACCESSORIES

- A. General: Comply with ASTM C 1063 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.
- B. Metal Accessories:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Alabama Metal Industries Corporation; a Gibraltar Industries company.
 - b. CEMCO.
 - c. Clark Western Building Systems.
 - d. Dietrich Metal Framing; a Worthington Industries company.
 - e. MarinoWARE.
 - f. Phillips Manufacturing Co.
 - 2. Foundation Weep Screed: Fabricated from hot-dip galvanized-steel sheet, ASTM A 653/A 653M, G60 zinc coating.

3. Cornerite: Fabricated from metal lath with ASTM A 653/A 653M, G60, hot-dip galvanized zinc coating.
4. External-Corner Reinforcement: Fabricated from metal lath with ASTM A 653/A 653M, G60, hot-dip galvanized zinc coating.
5. Cornerbeads: Fabricated from zinc or zinc-coated (galvanized) steel.
 - a. Small nose cornerbead with expanded flanges; use unless otherwise indicated.
 - b. Small nose cornerbead with perforated flanges; use on curved corners.
 - c. Small nose cornerbead with expanded flanges reinforced by perforated stiffening rib; use on columns and for finishing masonry corners.
6. Casing Beads: Fabricated from zinc or zinc-coated (galvanized) steel; square-edged style; with expanded flanges.
7. Control Joints: Fabricated from zinc or zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
8. Expansion Joints: Fabricated from zinc or zinc-coated (galvanized) steel; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.
9. Two-Piece Expansion Joints: Fabricated from zinc or zinc-coated (galvanized) steel; formed to produce slip-joint and square-edged reveal that is adjustable from 1/4 to 5/8 inch wide; with perforated flanges.

2.3 MISCELLANEOUS MATERIALS

- A. Water for Mixing and Finishing Plaster: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.
- B. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch long, free of contaminants, manufactured for use in portland cement plaster.
- C. Bonding Compound: ASTM C 932.
- D. Steel Drill Screws: For metal-to-metal fastening, ASTM C 1002 or ASTM C 954, as required by thickness of metal being fastened; with pan head that is suitable for application; in lengths required to achieve penetration through joined materials of no fewer than three exposed threads.
- E. Fasteners for Attaching Metal Lath to Substrates: Complying with ASTM C 1063.
- F. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch diameter, unless otherwise indicated.

2.4 PLASTER MATERIALS

- A. Portland Cement: ASTM C 150, Type I or Type II.
 1. Color for Finish Coats: White.
- B. Colorants for Job-Mixed Finish Coats: Colorfast mineral pigments that produce finish plaster color to match Architect's sample.
- C. Lime: ASTM C 206, Type S; or ASTM C 207, Type S.

- D. Sand Aggregate: ASTM C 897.

- 1. Color for Job-Mixed Finish Coats: In color to match Architect's sample.

2.5 PLASTER MIXES

- A. General: Comply with ASTM C 926 for applications indicated.

- 1. Fiber Content: Add fiber to base-coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 1 lb of fiber/cu. yd. of cementitious materials.

- B. Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork as follows:

- 1. Portland Cement Mixes:

- a. Scratch Coat: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
 - b. Brown Coat: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.

- C. Base-Coat Mixes for Use over Unit Masonry: Single base (scratch) coat for two-coat plasterwork on low-absorption plaster bases as follows:

- 1. Portland Cement Mix: For cementitious material, mix 1 part portland cement and 0 to 3/4 part lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.

- D. Base-Coat Mixes for Use over Unit Masonry: Single base (scratch) coat for two-coat plasterwork on high-absorption plaster bases as follows:

- 1. Portland Cement Mix: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.

- E. Job-Mixed Finish-Coat Mixes:

- 1. Portland Cement Mix: For cementitious materials, mix 1 part portland cement and 1-1/2 to 2 parts lime. Use 1-1/2 to 3 parts aggregate per part of cementitious material.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.
- B. Prepare smooth, solid substrates for plaster according to ASTM C 926.

3.3 INSTALLING METAL LATH

- A. Metal Lath: Install according to ASTM C 1063.
 - 1. Partition Framing and Vertical Furring: Install welded- or woven-wire lath.
 - 2. Flat-Ceiling and Horizontal Framing: Install welded- or woven-wire lath.
 - 3. Curved-Ceiling Framing: Install welded- or woven-wire lath.
 - 4. On Solid Surfaces, Not Otherwise Furred: Install self-furring, welded- or woven-wire lath.

3.4 INSTALLING ACCESSORIES

- A. Install according to ASTM C 1063 and at locations indicated on Drawings.
- B. Reinforcement for External (Outside) Corners:
 - 1. Install lath-type, external-corner reinforcement at exterior locations.
- A. Control Joints: Locate as approved by Architect for visual effect and as follows:
 - 1. As required to delineate plasterwork into areas (panels) of the following maximum sizes:
 - a. Vertical Surfaces: 144 sq. ft.
 - b. Horizontal and Other Nonvertical Surfaces: 100 sq. ft.
 - 2. At distances between control joints of not greater than 18 feet o.c.
 - 3. As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
 - 4. Where control joints occur in surface of construction directly behind plaster.
 - 5. Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.

3.5 PLASTER APPLICATION

- A. General: Comply with ASTM C 926.
 - 1. Do not deviate more than plus or minus 1/4 inch in 10 feet from a true plane in finished plaster surfaces, as measured by a 10-foot straightedge placed on surface.
 - 2. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
 - 3. Provide plaster surfaces that are ready to receive field-applied finishes indicated.
- B. Bonding Compound: Apply on unit masonry substrates for direct application of plaster.

- C. Walls; Base-Coat Mixes for Use over Metal Lath: For scratch and brown coats, for three-coat plasterwork with 1-inch total thickness, as follows:
 - 1. Portland cement mixes.
- D. Ceilings; Base-Coat Mixes for Use over Metal Lath: For scratch and brown coats, for three-coat plasterwork and having 1-inch total thickness, as follows:
 - 1. Portland cement mixes.
- E. Plaster Finish Coats: Apply to provide smooth and medium dash finishes to match Architect's samples.

3.6 PLASTER REPAIRS

- A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

3.7 PROTECTION

- A. Remove temporary protection and enclosure of other work. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION 092400

SECTION 09 29 00

GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.

B. Related Requirements:

1. Section 09 22 16 "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.

1.3 DELIVERY, STORAGE AND HANDLING

- ###### A.
- Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.4 FIELD CONDITIONS

- ###### A. Environmental Limitations:
- Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- ###### B.
- Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- ###### C.
- Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or blotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

- A. Recycled Content of Gypsum Panel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Gypsum.
 - 2. CertainTeed Corp.
 - 3. Georgia-Pacific Gypsum LLC.
 - 4. Lafarge North America Inc.
 - 5. National Gypsum Company.
 - 6. PABCO Gypsum.
 - 7. Temple-Inland.
 - 8. USG Corporation.
- B. Gypsum Board, Type X: ASTM C 1396/C 1396M.
 - 1. Thickness: 5/8 inch.
 - 2. Long Edges: Tapered.
- C. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
 - 1. Thickness: 1/2 inch, unless otherwise noted.
 - 2. Long Edges: Tapered.
- D. Abuse-Resistant Gypsum Board: ASTM C 1629/C 1629M.
 - 1. Core: 5/8 inch, Type X.
 - 2. Long Edges: Tapered.
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
 - 4. Level: As required by District.

- E. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M, with manufacturer's standard edges.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; GlasRoc Tile Backer.
 - b. Georgia-Pacific Gypsum LLC; DensShield Tile Backer.
2. Core: 5/8 inch, Type X.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

- B. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Custom Building Products; EasyBoard.
 - b. James Hardie Building Products, Inc.; Hardiebacker 500.
 - c. National Gypsum Company, Permabase Cement Board.
 - d. USG Corporation; DUROCK Cement Board.
2. Thickness: As indicated.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.5 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. L-Bead: L-shaped; exposed long flange receives joint compound.
 - d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - e. Expansion (control) joint.
 - f. Curved-Edge Cornerbead: With notched or flexible flanges.

- B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Fry Reglet Corp.
 - b. Gordon, Inc.
 - c. Pittcon Industries.
- 2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
- 3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.6 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
 - 2. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping or drying-type, all-purpose compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 - 3. Fill Coat: For second coat, use setting-type, sandable topping or drying-type, all-purpose compound.
 - 4. Finish Coat: For third coat, use setting-type, sandable topping or drying-type, all-purpose compound.
 - 5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound, drying-type, all-purpose compound, or high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.
- D. Joint Compound for Tile Backing Panels:
 - 1. Glass-Mat, Water-Resistant Backing Board: As recommended by backing panel manufacturer.
 - 2. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.7 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
 - 1. Laminating adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
 - 2. Recycled Content of Blankets: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- E. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
 - b. Grabber Construction Products; Acoustical Sealant GSC.
 - c. Pecora Corporation; AC-20 FTR.
 - d. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
 - e. USG Corporation; SHEETROCK Acoustical Sealant.
 - 2. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. Thermal Insulation: As specified in Section 07 21 00 "Thermal Insulation."
- G. Vapor Retarder: As specified in Section 07 21 00 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.

- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Wallboard Type: As indicated on Drawings.
 - 2. Type X: As indicated on Drawings.
 - 3. Flexible Type: Apply in double layer at curved assemblies.
 - 4. Ceiling Type: Ceiling surfaces.
 - 5. Abuse-Resistant Type: As indicated on Drawings.
 - 6. Moisture- and Mold-Resistant Type: As indicated on Drawings.
 - 7. Glass-Mat Water-Resistant Backing Board: As indicated on Drawings.
- B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels in either direction unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
1. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

- D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

E. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.4 APPLYING TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Backing Board: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile. Install with 1/4-inch gap where panels abut other construction or penetrations.
- B. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.

- C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners unless otherwise indicated.
 - 2. LC-Bead: Use where indicated at exposed panel edges.
 - 3. L-Bead: Use where indicated.
 - 4. U-Bead: Use where indicated at exposed panel edges.
 - 5. Curved-Edge Cornerbead: Use at curved openings.
- D. Aluminum Trim: Install in locations indicated on Drawings.

3.6 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- A. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 2: Panels that are substrate for tile.
 - 3. Level 3: As indicated on Drawings.
 - 4. Level 4: At panel surfaces that will be exposed to view and at panel surfaces indicated to receive chalkboard wallpaper, unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."
 - 5. Level 5: At panel surfaces exposed to view that will receive gloss and semi-gloss enamels.
 - a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."
- B. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

- C. Cementitious Backer Units: Finish according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.7 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 09 51 13

ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes acoustical panels and exposed suspension systems for ceilings.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product including weight of systems.
- B. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Suspended ceiling components.
 - 2. Structural members to which suspension systems will be attached.
 - 3. Size and location of initial access modules for acoustical panels.
 - 4. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - 5. Perimeter moldings.
- B. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.
- C. Evaluation Reports: For each acoustical panel ceiling suspension system from ICC-ES.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Acoustical Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.
 - 2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Accredited by National Voluntary Laboratory Accreditation Program for testing indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
 - 2. Smoke-Developed Index: 50 or less.
- C. Comply with DSA IR 25-2.13.

2.2 ACOUSTICAL PANELS, GENERAL

- A. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.
- B. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.
- C. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.
 - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface according to ASTM E 795.

2.3 ACOUSTICAL PANELS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Acoustical Panels indicated on Drawings or comparable product by one of the following:
 - 1. Armstrong World Industries, Inc.
 - 2. Chicago Metallic Corporation.
 - 3. USG Interiors, Inc.; Subsidiary of USG Corporation.
- B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
 - 1. Type and Form: Type III, mineral base with painted finish; Form 2, water felted.
 - 2. Pattern: CE (perforated, small holes and lightly textured).
 - 3. Color: White.
- C. LR: Not less than 0.85.
- D. NRC: Not less than 0.70.
- E. CAC: Not less than 35.
- F. Edge/Joint Detail: Angled tegular.
- G. Thickness: 3/4 inch
- H. Modular Size: 24 by 48 inches.
- I. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.

- B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
- C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - 2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.
- D. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- E. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
- F. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
- G. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in place.

2.5 METAL SUSPENSION SYSTEM

- A. Basis-of-Design Product: Subject to compliance with requirements, provide metal suspension system indicated on Drawings or comparable product by one of the following:
 - 1. Armstrong World Industries, Inc.
 - 2. CertainTeed Corp.
 - 3. Chicago Metallic Corporation.
 - 4. USG Interiors, Inc.; Subsidiary of USG Corporation.
- B. Wide-Face, Capped, Double-Web, Fire-Rated (where indicated), Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 coating designation; with prefinished, cold-rolled, 15/16-inch- wide metal caps on flanges, as indicated.
 - 1. Structural Classification: Heavy-duty system.
 - 2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
 - 3. Face Design: Flat, flush.
 - 4. Cap Material: Galvanized steel cold-rolled sheet.
 - 5. Cap Finish: Painted white. Color: Blizzard White.

2.6 METAL EDGE MOLDINGS AND TRIM

- A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
 - 1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.

2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical panel and tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine acoustical panels and tiles before installation. Reject acoustical panels and tiles that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels and tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION, GENERAL

- A. Install acoustical panel and tile ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
 1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.

3.4 INSTALLATION OF ACOUSTICAL PANEL CEILINGS

- A. Suspend ceiling hangers from building's structural members and as follows:
 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts,

- eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 7. Do not attach hangers to steel deck tabs.
 8. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- B. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
- D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
 2. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.

3.5 CLEANING

- A. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 09 65 13

RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Resilient base.
2. Resilient molding accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

A. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.

B. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.5 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. FloorScore Compliance: Resilient base and accessories shall comply with requirements of FloorScore certification.

2.2 THERMOPLASTIC-RUBBER BASE

- A. Basis-of-Design Products: Subject to compliance with requirements, provide rubber base indicated on Drawings or comparable product by one of the following:
 - 1. Armstrong World Industries, Inc.
 - 2. Burke Mercer Flooring Products, Division of Burke Industries Inc.
 - 3. Flexco.
 - 4. Johnsonite
 - 5. Roppe.
- B. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).
 - 1. Group: I (solid, homogeneous).
 - 2. Style: As indicated.
- C. Thickness: Manufacturer's standard thicknesses for products indicated.
- D. Heights: 4 inches and 5 inches in locations indicated.
- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: Job formed or preformed.
- G. Inside Corners: Job formed or preformed.
- H. Colors: As indicated by manufacturer's designations.

2.3 RUBBER MOLDING ACCESSORY

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Roppe Corporation, USA.
 - 2. VPI, LLC, Floor Products Division.
- B. Description: Rubber transition strips.

- C. Profile and Dimensions: As indicated.
- D. Locations: Provide rubber molding accessories in areas indicated.
- E. Colors and Patterns: As selected by Architect.

2.4 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
 - 1. Adhesives shall have a VOC content of 50 g/L or less.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until they are the same temperature as the space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.
- H. Job-Formed Corners:
 - 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Form without producing discoloration (whitening) at bends.
 - 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Miter or cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 09 65 19

RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vinyl composition floor tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

1. Show details of special patterns.

C. Samples: Full-size units of each color and pattern of floor tile required.

D. Product Schedule: For floor tile. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.8 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:
 1. 48 hours before installation.
 2. During installation.
 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
- B. Resilient tile flooring shall be stable, firm and slip resistant. CBC Section 11B-302.1.

2.2 VINYL COMPOSITION FLOOR TILE

- A. Basis of Design Products: Subject to compliance with requirements, provide Vinyl Composition Tiles indicated on Drawings, or comparable products by one of the following:
 1. Armstrong World Industries, Inc.
 2. Congoleum Corporation.
 3. Mannington Mills, Inc.
- B. Tile Standard: ASTM F 1066, Class 2, through-pattern tile.
- C. Wearing Surface: Smooth.

- D. Thickness: 0.125 inch.
- E. Sizes: As indicated on Drawings.
- F. Colors and Patterns: As indicated by manufacturer's designations.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
 - 1. Adhesives shall have a VOC content of 50 g/L or less.
- C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 - 4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:

- a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles in pattern indicated.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 - 1. Lay tiles in pattern of colors and sizes indicated.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.
 - 1. Apply two coat(s).
- E. Cover floor tile until Substantial Completion.

END OF SECTION 096519

SECTION 09 68 13

TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes modular, tufted carpet tile.
- B. Related Requirements:
 - 1. Section 09 65 13 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show the following:
 - 1. Carpet tile type, color, and dye lot.
 - 2. Type of subfloor.
 - 3. Type of installation.
 - 4. Transition details to other flooring materials.
- C. Samples: For each of the following products:
 - 1. Carpet Tile: Full-size Sample.
 - 2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- long Samples.

1.3 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 - 2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Two unopened boxes for each type installed.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104.

1.7 FIELD CONDITIONS

- A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.
- C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

1.8 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
 2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, loss of tuft bind strength, loss of face fiber, and delamination.
 3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Carpet shall be securely attached and shall have a firm cushion, pad, or backing or no cushion or pad. It shall have a level loop, textured loop, level cut pile, or level cut/uncut pile texture. Pile height shall be 1/2-inch maximum. CBC Section 11B-302.2.
- B. Exposed edges shall be fastened to floor surfaces and shall have trim on the entire length. Carpet edges shall comply with CBC Section 11B-303. CBC Section 11B-302.2.

2.2 CARPET TILE

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings.
- A. Applied Soil-Resistance Treatment: Manufacturer's standard material.
- B. Antimicrobial Treatment: Manufacturer's standard material.

C. Performance Characteristics: As follows:

1. Emissions: Provide carpet tile that complies with testing and product requirements of CRI's "Green Label Plus" program.
2. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm according to NFPA 253.

2.3 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.
1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
 2. Subfloor finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" for slabs receiving carpet tile.
 3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks,

holes and depressions 1/8 inch wide or wider and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

- A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.
- C. Maintain dye lot integrity. Do not mix dye lots in same area.
- D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
- G. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
 - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 - 2. Remove yarns that protrude from carpet tile surface.
 - 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 09 77 23

FABRIC-WRAPPED TACKABLE PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes shop-fabricated, fabric-wrapped tackable wall panels.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of fabric facing, panel edge, core material, and mounting indicated.
- B. Shop Drawings: For panel assembly and installation.
 - 1. Include plans, elevations, sections, and mounting devices and details.
 - 2. Include details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Indicate panel edge profile and core materials.
 - 3. Include details at cutouts and penetrations for other work.
 - 4. Include direction of fabric weave and pattern matching.
- A. Samples for Verification: For the following products:
 - 1. Fabric: Full-width by approximately 36-inch- long Sample, but not smaller than required to show complete pattern repeat, from dye lot to be used for the Work, and with specified treatments applied. Mark top and face of fabric.
 - 2. Panel Edge: 12-inch- long Sample(s) showing each edge profile, corner, and finish.
 - 3. Core Material: 12-inch- square Sample at corner.
 - 4. Mounting Devices: Full-size Samples.
 - 5. Assembled Panels: Approximately 36 by 36 inches, including joints and mounting methods.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Elevations 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. Electrical outlets, switches, and thermostats.
 - 2. Items penetrating or covered by fabric-wrapped wall panels including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Alarms.
 - e. Sprinklers.
 - f. Access panels.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fabric-wrapped wall panels to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal recommendations.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with fabric and fabric-wrapped, wall panel manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.
- B. Deliver materials and panels in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not install fabric-wrapped wall panels until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Lighting: Do not install fabric-wrapped wall panels until a permanent level of lighting is provided on surfaces to receive fabric-wrapped wall panels.
- C. Air-Quality Limitations: Protect fabric-wrapped wall panels from exposure to airborne odors such as tobacco smoke, and install panels under conditions free from odor contamination of ambient air.
- D. Field Measurements: Verify locations of fabric-wrapped wall panels and actual dimensions of openings and penetrations by field measurements before fabrication.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace panels and components that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Fabric sagging, distorting, or releasing from panel edge.
 - b. Warping of core.
 - 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain fabric-wrapped wall panels from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: Panels shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. Surface-Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 - 2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.

2.3 FABRIC-WRAPPED WALL PANELS

- A. Fabric-Wrapped Wall Panel: Manufacturer's standard panel construction consisting of facing material stretched over front face of edge-framed core and bonded or attached to edges and back of frame.
 - 1. Panel Shape: Flat.
 - 2. Mounting: Back mounted with manufacturer's standard metal clips or bar hangers, secured to substrate.
 - 3. Core: Manufacturer's standard glass-fiber board.
 - a. Core-Face Layer: Manufacturer's standard tackable, impact-resistant, high-density board.
 - 4. Edge Construction: Manufacturer's standard chemically hardened core with no frame.
 - 5. Edge Profile: As indicated.
 - 6. Reveals between Panels: As indicated.
 - 7. Facing Material: As indicated.
 - 8. Nominal Overall Panel Thickness: 1 inch.
 - 9. Panel Width: As indicated.
 - 10. Panel Height: As indicated.

2.4 MATERIALS

- A. Core Materials:
 - 1. Glass-Fiber Board: ASTM C 612; Type standard with manufacturer; nominal density of 6 to 7 lb/cu. ft., unfaced, and dimensionally stable, molded rigid board; and with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.
 - 2. Tackable, Impact-Resistant, High-Density Board for Face Layer: 1/8-inch- thick layer of compressed, molded glass-fiber board with a nominal density of 16 to 18 lb/cu. ft. laminated to face of core.
- B. Facing Material: Fabric from same dye lot; color and pattern as indicated on Drawings:

1. Basis-of-Design Product: Subject to compliance with requirements, provide products indicated on Drawings or comparable product by one of the following:
 - a. DesignTex Inc.; a Steelcase company.
 - b. Knoll, Inc.
 - c. Maharam.
 - d. MDC Wallcoverings.
2. Applied Treatments: Stain resistance.
- C. Mounting Devices: Concealed on back of panel, recommended by manufacturer to support weight of panel, and as follows:
 1. Metal Clips or Bar Hangers: Manufacturer's standard two-part metal "Z" clips, with one part of each clip mechanically attached to back of panel and the other part to substrate, designed to permit unit removal.

2.5 FABRICATION

- A. Standard Construction: Use manufacturer's standard construction unless otherwise indicated; with facing material applied to face, edges, and back border of dimensionally stable core; and with rigid edges to reinforce panel perimeter against warpage and damage.
- B. Edge Hardening: For glass-fiber board cores, chemically harden core edges and areas of core where mounting devices are attached.
- C. Core-Face Layer: Evenly stretched over core face and edges and securely attached to core; free from puckers, ripples, wrinkles, or sags.
- D. Facing Material: Apply fabric fully covering visible surfaces of panel; with material stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other visible distortions or foreign matter.
- E. Dimensional Tolerances of Finished Panels: Plus or minus 1/16 inch for the following:
 1. Thickness.
 2. Edge straightness.
 3. Overall length and width.
 4. Squareness from corner to corner.
 5. Chords, radii, and diameters.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fabric, fabricated panels, substrates, areas, and conditions, for compliance with requirements, installation tolerances, and other conditions affecting performance of fabric-wrapped wall panels.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install panels in locations indicated. Unless otherwise indicated, install panels with vertical surfaces and edges plumb, top edges level and in alignment with other panels, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.
- B. Comply with manufacturer's written instructions for installation of panels using type of mounting devices indicated. Mount panels securely to supporting substrate.
- C. Align fabric pattern and grain with adjacent panels.

3.3 INSTALLATION TOLERANCES

- A. Variation from Plumb and Level: Plus or minus 1/16 inch.
- A. Variation of Joint Width: Not more than 1/16 inch wide from hairline in 48 inches, noncumulative.

3.4 CLEANING

- A. Clip loose threads; remove pills and extraneous materials.
- B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 097723

SECTION 09 91 13

EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following exterior substrates:
 - 1. Steel.
 - 2. Galvanized metal.
 - 3. Concrete.
 - 4. Exterior portland cement plaster (stucco).
 - 5. Wood.
- B. Related Requirements:
 - 1. Section 05 52 13 "Pipe and Tube Railings" for shop priming pipe and tube railings.
 - 2. Section 09 96 00 "High-Performance Coatings" for tile-like coatings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Indicate VOC content.
- B. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.4 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Location: Provide mock up 6 feet wide by full height of building in location as directed by Architect.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints in rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide products named in the Exterior Painting Schedule in Part 3 or comparable products by one of the following:
 - 1. Benjamin Moore & Co.
 - 2. Dunn-Edwards Corporation.
 - 3. PPG Architectural Finishes, Inc.
 - 4. Sherwin-Williams Company (The).
 - 5. Vista Paint.

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.

C. Colors: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Portland Cement Plaster: 12 percent.
3. Wood: 15 percent.

C. Portland Cement Plaster Substrates: Verify that plaster is fully cured.

D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.
- F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- H. Wood Substrates:
1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
 2. Sand surfaces that will be exposed to view, and dust off.
 3. Prime edges, ends, faces, undersides, and backsides of wood.
 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
1. Use applicators and techniques suited for paint and substrate indicated.
 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 4. Paint entire exposed surface of window frames and sashes.
 5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

- A. Ferrous-Metal Substrates:
 - 1. Prime Coat: ProCryl Acrylic Metal Primer B66 Series; Sherwin-Williams Company (The).
 - 2. Intermediate Coat: Same as topcoat.
 - 3. Topcoat: ProIndustrial Zero VOC Acrylic Semigloss B66-650; Sherwin-Williams Company (The).
- B. Galvanized-Metal Substrates:
 - 1. Prime Coat: ProCryl Acrylic Metal Primer B66 Series; Sherwin-Williams Company (The).
 - 2. Intermediate Coat: Same as topcoat.
 - 3. Topcoat: ProIndustrial Zero VOC Acrylic Semigloss B66-650; Sherwin-Williams Company (The).
- C. Cement Plaster and Concrete Substrates:
 - 1. Prime Coat: Loxon Exterior Masonry Acrylic Primer A24W8300; Sherwin-Williams Company (The).
 - 2. Intermediate Coat: A-100 Flat A6 Series; Sherwin-Williams Company (The).
 - 3. Top Coat: A-100 Flat A6 Series; Sherwin-Williams Company (The).
- D. Wood:
 - 1. Prime Coat: A-100 Exterior Alkyd Wood Primer Y24W20; Sherwin-Williams Company (The).
 - 2. Intermediate Coat: Same as topcoat.
 - 3. Topcoat: A-100 Flat A6 Series; Sherwin-Williams Company (The).

END OF SECTION 099113

SECTION 09 91 23

INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following interior substrates:
 - 1. Aluminum (not anodized or otherwise coated).
 - 2. Steel.
 - 3. Wood.
 - 4. Gypsum board.
- B. Related Requirements:
 - 1. Section 05 50 00 "Metal Fabrications" for shop priming metal fabrications.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Indicate VOC content.
- B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than 1 gallon of each material and color applied.

1.4 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
 - b. Other Items: Architect will designate items or areas required.
2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

- A. Products (P-6 through P-8): Subject to compliance with requirements, provide products named in the Exterior Painting Schedule in Part 3 or comparable products by one of the following:
 1. Benjamin Moore & Co.
 2. Dunn-Edwards Corporation.
 3. PPG Architectural Finishes, Inc.
 4. Rosco Laboratories, Inc.
 5. Sherwin-Williams Company (The).
 6. Vista Paint.

2.2 PAINT, GENERAL

- A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- B. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.
- C. Colors: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Wood: 15 percent.
 2. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.

- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- F. Aluminum Substrates: Remove loose surface oxidation.
- G. Wood Substrates:
 - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- D. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by Architect.
 - 2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

- A. Aluminum (not anodized or otherwise coated):
 - 1. Prime Coat: ProCryl Acrylic Metal Primer B66-310 Series; Sherwin-Williams Company (The).
 - 2. Intermediate Coat: Same as topcoat.
 - 3. Topcoat: ProIndustrial Acrylic Eg-Shel Enamel B66-660; Sherwin-Williams Company (The).
- B. Wood:
 - 1. Prime Coat: PrepRite Problock Latex Primer B51W8020; Sherwin-Williams Company (The).
 - 2. Intermediate Coat: Same as topcoat.
 - 3. Topcoat: ProIndustrial Acrylic Semi-Gloss Enamel B66-660; Sherwin-Williams Company (The).
- C. Gypsum board:
 - 1. Prime Coat: ProMar 400 Zero VOC Primer B28W4600; Sherwin-Williams Company (The).
 - 2. Intermediate Coat: Same as topcoat.
 - 3. Topcoat: ProMar 200 Zero VOC Latex Flat and Eg-Shel and Semi-Gloss Enamel B20W2600 Series; Sherwin-Williams Company (The).
- D. Ferrous Metal:

1. Prime Coat: ProCryl Acrylic Metal Primer B66-310 Series; Sherwin-Williams Company (The).
2. Intermediate Coat: Same as topcoat.
3. Topcoat: ProIndustrial Acrylic Semi-Gloss Enamel B31W651; Sherwin-Williams Company (The).

END OF SECTION 099123

SECTION 09 96 00

HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of high-performance coating systems on the following substrates:
 - 1. Exterior Substrates:
 - a. Steel.
 - b. Galvanized metal.
- B. Related Requirements:
 - 1. Section 05 00 00 "Metal Fabrications" for shop priming of metal fabrications with primers specified in this Section.
 - 2. Section 05 52 13 "Pipe and Tube Railings" for shop priming pipe and tube railings with coatings specified in this Section.
 - 3. Section 09 91 13 "Exterior Painting" for general field painting.
 - 4. Section 09 91 23 "Interior Painting" for general field painting.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Indicate VOC content.
- B. Samples for Initial Selection: For each type of topcoat product indicated.
- C. Samples for Verification: For each type of coating system and each color and gloss of topcoat indicated.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Apply coats on Samples in steps to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- D. Product List: Cross-reference to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Coatings: 5 percent, but not less than 1 gal. of each material and color applied.

1.4 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 1. Architect will select one surface to represent surfaces and conditions for application of each coating system.
 - a. Other Items: Architect will designate items or areas required.
 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
- C. Do not apply exterior coatings in rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design Products: Subject to compliance with requirements, provide products listed in Exterior High-Performance Coating Schedule at the end of this Section or comparable product by one of the following:

1. Benjamin Moore & Co.
2. PPG Architectural Finishes, Inc.
3. Sherwin-Williams Company (The).
4. Vista Paint.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
3. Products shall be of same manufacturer for each coat in a coating system.

B. VOC Content: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Primers, Sealers, and Undercoaters: 200 g/L.
4. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
5. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
6. Pretreatment Wash Primers: 420 g/L.
7. Shellacs, Clear: 730 g/L.
8. Shellacs, Pigmented: 550 g/L.

C. Colors: As indicated in color schedule.

2.3 SOURCE QUALITY CONTROL

A. Testing of Coating Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample coating materials. Contractor will be notified in advance and may be present when samples are taken. If coating materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions applicable to substrates and coating systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

3.3 APPLICATION

- A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
 - 1. Use applicators and techniques suited for coating and substrate indicated.
 - 2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.

3. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
- C. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.
1. Contractor shall touch up and restore coated surfaces damaged by testing.
 2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.6 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

- A. Steel Substrates:
1. Pigmented Polyurethane over Epoxy System (Carboline):
 - a. First Coat: Carboguard 890 VOC Epoxy.
 - b. Second Coat: Carbothane 133 MC Aliphatic Polyurethane Semi-Gloss.
 - c. Third Coat: Carbothane 133 MC Aliphatic Polyurethane Semi-Gloss.
- B. Galvanized-Metal Substrates:
1. Pigmented Polyurethane over WB Wash System (Carboline):

- a. Surface Prep:SSPC – SP1 Chemical/Solvent Clean.
- b. First Coat: Carboline Galoseal WB Wash Primer.
- c. Second Coat: Carbothane 133 MC Aliphatic Polyurethane Semi-Gloss.
- d. Third Coat: Carbothane 133 MC Aliphatic Polyurethane Semi-Gloss.

END OF SECTION 099600

SECTION 10 11 00

VISUAL DISPLAY UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Visual display board assemblies.

1.2 PREINSTALLATION MEETINGS

- ###### A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles and finishes for visual display units.

B. Shop Drawings: For visual display units.

1. Include plans, elevations, sections, details, and attachment to other work.
2. Include sections of typical trim members.

C. Samples: For each type of visual display unit indicated.

1. Visual Display Panel: Not less than 8-1/2 by 11 inches, with facing, core, and backing indicated.
2. Trim: 6-inch- long sections of each trim profile.

1.4 INFORMATIONAL SUBMITTALS

- ###### A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface-burning characteristics of tackboards.

- ###### B. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- ###### A. Maintenance Data: For visual display units to include in maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver factory-fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install visual display units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Verify actual dimensions of construction contiguous with visual display units by field measurements before fabrication.
 - 1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

1.8 WARRANTY

- A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Surfaces lose original writing and erasing qualities.
 - b. Surfaces exhibit crazing, cracking, or flaking.
 - 2. Warranty Period: 50 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of visual display unit from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 50 or less.

2.3 VISUAL DISPLAY BOARD ASSEMBLY

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ADP Lemco, Inc.
 - 2. Best-Rite Manufacturing; a brand division of MooreCo, Inc.
 - 3. Claridge Products and Equipment, Inc.
 - 4. Egan Visual Inc.
- B. Visual Display Board Assembly: Factory fabricated.
 - 1. Assembly: Markerboard for writing and projecting.
 - 2. Corners: Square.
 - 3. Width: As indicated on Drawings.
 - 4. Height: As indicated on Drawings.
 - 5. Mounting Method: Direct to wall.
- C. Markerboard Panel: Porcelain-enamel-faced markerboard panel on core indicated.
 - 1. Color: As selected by Architect from full range of industry colors.
- D. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- thick, extruded aluminum; standard size and shape.
 - 1. Aluminum Finish: Clear anodic finish.
- E. Chalktray: Manufacturer's removable magnetic type.
 - 1. Solid Type: Extruded aluminum with ribbed section and smoothly curved exposed ends.
- F. Display Rail: Manufacturer's standard, extruded-aluminum display rail with plastic-impregnated-cork insert, end stops, designed to hold accessories.
 - 1. Size: As indicated on Drawings.
 - 2. Map Hooks and Clips: Two map hooks with flexible metal clips for every 48 inches of display rail or fraction thereof.
 - 3. Flag Holder: One for each room.
 - 4. Tackboard Insert Color: As selected by Architect from full range of industry colors.
 - 5. Aluminum Color: Match finish of visual display assembly trim.

2.4 MATERIALS

- A. Porcelain-Enamel Face Sheet: PEI-1002, with face sheet manufacturer's standard two- or three-coat process.
- B. Plastic-Impregnated-Cork Sheet: Seamless, homogeneous, self-sealing sheet consisting of granulated cork, linseed oil, resin binders, and dry pigments that are mixed and calendared onto fabric backing; with washable vinyl finish and integral color throughout.
- C. Medium-Density Fiberboard: ANSI A208.2; made with binder containing no urea formaldehyde.
- D. Extruded Aluminum: ASTM B 221, Alloy 6063.

- E. Adhesives for Field Application: Mildew-resistant, nonstaining adhesive for use with specific type of panels, sheets, or assemblies; and for substrate application; as recommended in writing by visual display unit manufacturer.

- 1. Adhesives shall have a VOC content of 50 g/L or less.

2.5 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.
- B. Examine walls and partitions for proper preparation and backing for visual display units.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances, such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.
- C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display units and wall surfaces.

3.3 INSTALLATION

- A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level,

and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors and trim necessary for complete installation.

- B. Installation: Adhere to wall surfaces with adhesive gobs at 16 inches o.c., horizontally and vertically or attach to walls with concealed clips, hangers, and grounds with fasteners at not more than 16 inches o.c., as recommended by manufacturer. Secure tops and bottoms of boards to walls.
- C. Visual Display Board Assembly Mounting Heights: Install visual display units at mounting heights indicated on Drawings.

3.4 CLEANING AND PROTECTION

- A. Clean visual display units according to manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.
- B. Touch up factory-applied finishes to restore damaged or soiled areas.
- C. Cover and protect visual display units after installation and cleaning.

END OF SECTION 101100

SECTION 10 14 23

PANEL SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Panel signs.

B. Related Requirements:

1. Section 01 50 00 "Temporary Facilities and Controls" for temporary Project identification signs and for temporary information and directional signs.
2. Section 10 14 26 "Post and Panel Signage" for freestanding signs.

1.2 DEFINITIONS

- A. Accessible: In accordance with the accessibility standard.

1.3 COORDINATION

- A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Shop Drawings: For panel signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

- C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

- D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Exposed Accessories: Full-size Sample of each accessory type.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For signs to include in maintenance manuals.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image.
 - c. Separation or delamination of sheet materials and components.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and CCR Title 24 for signs.
- B. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SIGNS

- A. Panel Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
 - 1. Solid-Sheet Sign: Acrylic or PVC sheet with finish specified and as follows:

- a. Thickness: Manufacturer's standard for size of sign.
 - b. Etched and Filled Graphics: Sign face etched or routed to receive enamel-paint infill.
 - c. Inset, Cutout Characters: Sign face routed to receive push-through acrylic graphics flush with the sign panel.
- 2. Laminated-Sheet Sign: Photopolymer face sheet with raised graphics laminated to backing sheet to produce composite sheet.
 - a. Composite-Sheet Thickness: Manufacturer's standard for size of sign.
- 3. Laminated Polycarbonate-Sheet Sign: Polycarbonate face sheet laminated to each side of phenolic base sheet to produce composite sheet.
 - a. Composite-Sheet Thickness: Manufacturer's standard for size of sign.
- 4. Engraved Plastic-Laminate Sign: Plastic-laminate face laminated to contrasting phenolic core to produce composite sheet.
 - a. Composite-Sheet Thickness: Manufacturer's standard for size of sign.
 - b. Engraved Graphics: Characters engraved through plastic-laminate face sheet to expose contrasting phenolic core.
 - c. Plastic-Laminate Color and Pattern: As selected by Architect from manufacturer's full range.
 - d. Core Color: Manufacturer's standard dark color.

2.3 PANEL-SIGN MATERIALS

- A. Acrylic Sheet: ASTM D 4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).
- B. Polycarbonate Sheet: ASTM C 1349, Appendix X1, Type II (coated, mar-resistant, UV-stabilized polycarbonate), with coating on both sides.
- A. Plastic-Laminate Sheet: NEMA LD 3, general-purpose HGS grade, 0.048-inch nominal thickness.
- B. Vinyl Film: UV-resistant vinyl film of nominal thickness indicated, with pressure-sensitive, permanent adhesive on back; die cut to form characters or images as indicated and suitable for exterior applications.
- C. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.4 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:
 - 1. Use concealed fasteners and anchors unless indicated to be exposed.
 - 2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.

3. Inserts: Furnish inserts to be set by other trades into concrete or masonry work.
- B. Adhesive: As recommended by sign manufacturer.
1. Adhesives shall have a VOC content of 70 g/L or less.

2.5 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
1. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
 2. Internally brace signs for stability and for securing fasteners.
 3. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
- B. Surface-Engraved Graphics: Machine engrave characters and other graphic devices into panel surface indicated to produce precisely formed copy, incised to uniform depth.
1. Engraved Opaque Acrylic Sheet: Fill engraved graphics with manufacturer's standard enamel.
 2. Face-Engraved Clear Acrylic Sheet: Fill engraved copy with manufacturer's standard enamel. Apply manufacturer's standard opaque background color coating to back face of acrylic sheet.
 3. Engraved Plastic Laminate: Engrave through exposed face ply of plastic-laminate sheet to expose contrasting core ply.
- C. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.
- D. Subsurface-Engraved Graphics: Reverse engrave back face of clear face-sheet material. Fill resulting copy with manufacturer's standard enamel. Apply opaque manufacturer's standard background color coating over enamel-filled copy.
- E. Shop- and Subsurface-Applied Vinyl: Align vinyl film in final position and apply to surface. Firmly press film from the middle outward to obtain good bond without blisters or fishmouths.
- F. Raised characters shall comply with CBC Section 11B-703.2
1. Depth: It shall be 1/32-inch minimum above their background and shall be sans serif uppercase and be duplicated in Braille.
 2. Height: It shall be 5/8-inch minimum and 2 inches maximum based on the height of the uppercase letter "I". CBC Section 11B-703.2.5.
 3. Finish and Contrast: Characters and their background shall have a non-glare finish. Character shall contrast with their background with either light characters on a dark background or dark characters on a light background. CBC Section 11B-703.5.1.
 4. Proportions: It shall be selected from fonts where the width of the uppercase letter "O" is 60 percent minimum and 110 percent maximum of the height of the uppercase letter "I". Stroke thickness of the uppercase letter "I" shall be 15 percent maximum of the height of the character. CBC Sections 11B-703.2.4 and 11B-703.2.6.
 5. Character Spacing: Spacing between individual tactile characters shall comply with CBC Section 11B-703.2.7 and 11B-703.2.8.

6. Braille: It shall be contracted (Grade 2) and shall comply with CBC Sections 11B-703.3 and 11B-703.4. Braille dots shall have a domed and rounded shape and shall comply with CBC Table and Figure 11B-703.3.1.
 7. Mounting Height: Tactile characters on signs shall be located 48 inches minimum to the baseline of the lowest Braille cells and 60 inches maximum to the baseline of the highest line of raised characters above the finish floor or ground surface. CBC Section and Figure 11B-703.4.1.
 8. Mounting Location: A tactile sign shall be located per CBC Section and Figure 11B-703.4.2 as follows:
 - a. Alongside a single door at the latch side.
 - b. On the inactive leaf of a double door with one active leaf.
 - c. To the right of the right hand door at double doors with two active leafs.
 - d. On the nearest adjacent wall where there is no wall space at the latch side of a single door or at the right side of a double door with two active leafs.
 - e. So that a clear floor space of 18 inches by 18 inches minimum, centered on the tactile characters, is provided beyond the arc of any door swing between the closed position and 45-degree open position.
 9. Visual Characters shall comply with CBC Section 11B-703.5 and shall be 40 inches minimum above finish floor or ground.
 10. Pictograms shall comply with CBC Section 11B-703.6
 11. Symbols of Accessibility shall comply with CBC Section 11B-703.7.
 12. Variable message signs shall comply with CBC Section 11B-703.8.
- G. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.
1. Stainless-Steel Brackets: Factory finish brackets to match sign background unless otherwise indicated.

2.6 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

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 signage work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

- C. Verify that anchor inserts are correctly sized and located to accommodate signs.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Install signs so they do not protrude or obstruct according to the accessibility standard.
 - 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
 - 4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Mounting Methods:
 - 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
 - b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
 - 2. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.
 - b. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.
 - 3. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
 - 4. Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position so that signage is correctly located and aligned.
 - 5. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101423

SECTION 10 14 26

POST AND PANEL SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nonilluminated post and panel signs.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For post and panel signage.

C. Samples: For each exposed product and for each color and texture specified.

1.3 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

B. Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and CCR Title 24.

2.2 POST AND PANEL SIGNS

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. ASI Sign Systems, Inc.

2. Clarke Systems.
3. Fossil Industries, Inc.
4. Nelson-Harkins Industries.
5. Poblocki Sign Company, LLC.
6. Vomar Products, Inc.

B. Post and Panel Sign: Sign of single-panel configuration; with smooth, uniform surfaces and support assembly; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Solid-Sheet Sign Panels: Aluminum sheet with finish specified in "Sign-Panel-Face Finish and Applied Graphics" Subparagraph below and as follows:
 - a. Surface-Applied Graphics: Applied baked enamel or powder coat.
2. Posts: Steel
 - a. Shape: Round.
 - b. Size: As indicated on Drawings.
 - c. Installation Method: As indicated on Drawings.
 - d. Finish and Color: Mill.
3. Sign-Panel-Face Finish and Applied Graphics:
 - a. Baked-Enamel or Powder-Coat Finish and Graphics: Manufacturer's standard, in color as selected by Architect from manufacturer's full range.

2.3 MATERIALS

- A. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- C. Steel Materials:
 1. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, G90 coating, either commercial or forming steel.
 2. Steel Sheet: Uncoated, cold-rolled, ASTM A 1008/A 1008M, commercial steel, Type B, exposed or electrolytic zinc-coated, ASTM A 879/A 879M, Coating Designation 08Z, with steel sheet substrate according to ASTM A 1008/A 1008M, commercial steel, exposed.
 3. Hot-Rolled, Structural-Steel Shapes: ASTM A 36/A 36M or ASTM A 529/A 529M.
 4. Steel Members Fabricated from Plate or Bar Stock: ASTM A 529/A 529M or ASTM A 572/A 572M, 42,000-psi minimum yield strength.
 5. Steel Tubing or Pipe: ASTM A 500, Grade B.
 6. Bolts for Steel Framing: ASTM A 307 or ASTM A 325 as necessary for design loads and connection details.
 7. For steel exposed to view on completion, provide materials having flat, smooth surfaces without blemishes. Do not use materials whose surfaces exhibit pitting, seam marks, roller marks, rolled trade names, or roughness.

- D. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.4 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:
 - 1. Use concealed fasteners and anchors unless indicated to be exposed.
 - 2. For exterior exposure, furnish nonferrous-metal devices unless otherwise indicated.
 - 3. Exposed Metal-Fastener Components, General:
 - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
- B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- C. Anchoring Materials:
 - 1. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
 - 2. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 - a. Water-Resistant Product: At exterior locations, provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.5 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 - 1. Mill joints to tight, hairline fit. Form joints exposed to weather to resist water penetration and retention.
 - 2. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed joints of flux, and dress exposed and contact surfaces.
 - 3. Conceal fasteners and anchors unless indicated to be exposed; locate exposed fasteners where they will be inconspicuous.
 - 4. Internally brace signs for stability and for securing fasteners.
- B. Post Fabrication: Fabricate posts designed to withstand wind pressure indicated for Project location and of lengths required for installation method indicated for each sign.
 - 1. Steel Posts: Fabricate from minimum 0.120-inch- thick steel tubing unless otherwise indicated. Include post caps, fillers, spacers, junction boxes, access panels, reinforcement where required for loading conditions, and related accessories required for complete installation.

- a. Hot-dip galvanize post assemblies after fabrication according to ASTM A 123/A 123M.
2. Direct Burial: Fabricate posts 36 inches longer than height of sign to permit direct burial or embedment in concrete foundations or concrete-filled postholes.
3. Baseplates: Fabricate posts with baseplates welded to bottom of posts. Drill holes in baseplate for anchor-bolt connection.
 - a. Provide drilled-in-place anchor bolts of size required for connecting posts to concrete foundations.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install signs using installation methods indicated and according to manufacturer's written instructions.
 1. Install signs level, plumb, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 2. Install signs so they do not protrude or obstruct according to accessibility standard.
 3. Before installation, verify that sign components are clean and free of materials or debris that would impair installation.
 4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.2 INSTALLING POSTS

- A. Direct-Burial Method:
 1. Excavation: Excavate posthole to dimensions indicated. Reconstruct subgrade that is not firm, undisturbed, or compacted soil, or that is damaged by freezing temperatures, frost, rain, accumulated water, or construction activities by excavating an additional 12 inches backfilling with satisfactory soil or well-graded aggregate, and compacting to original subgrade elevation.
 2. Setting in Earth: Set post in position, support to prevent movement, and backfill with satisfactory soil or well-graded aggregate as recommended in writing by manufacturer. Place and compact backfill in 6-inch lifts, compacting each lift.
 3. Setting in Cast-in-Place Concrete: Set post in position, support to prevent movement, and place concrete in posthole or for concrete foundation as indicated.
- B. Baseplate Method:
 1. Drilled-in-Place Anchor Bolts: Set post baseplate in position over concrete foundation, locate and drill anchor holes, shim and support post to prevent movement, place washers and anchor bolts, and tighten. Fill shim space with nonshrink, nonmetallic grout, mixed and placed to comply with manufacturer's written instructions.

END OF SECTION 101426

SECTION 102113

PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-plastic toilet compartments configured as toilet enclosure panels and urinal screens.

B. Related Requirements:

1. Section 05 50 00 "Metal Fabrications" for supports that attach floor-and-ceiling-anchored compartments to overhead structural system.
2. Section 10 28 00 "Toilet Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories mounted on toilet compartments.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings: For toilet compartments.

1. Include plans, elevations, sections, details, and attachment details.
2. Show locations of cutouts for compartment-mounted toilet accessories.
3. Show locations of centerlines of toilet fixtures.
4. Show locations of floor drains.
5. Show wall support or bracing locations.

C. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:

1. Each type of material, color, and finish required for toilet compartments, prepared on 6-inch-square Samples of same thickness and material indicated for Work.
2. Each type of hardware and accessory.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of toilet compartment.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 75 or less.
 - 2. Smoke-Developed Index: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and CCR Title 24 for toilet compartments designated as accessible.
- C. Accessible Toilet Compartments:
 - 1. Wheelchair accessible compartment shall comply with CBC Section 11B-604.8.1.
 - 2. Toe clearance for at least one side partition of a wheelchair accessible compartment shall comply with CBC Section and Figure 11B-604.8.1.4. It shall be 9 inches high minimum above the finish floor and 6 inches deep minimum beyond the compartment side face of the partition, exclusive of partition support members. It shall be 12 inches high minimum above the finish floor for children's use. Partition components at toe clearances shall be smooth without sharp edges or abrasive surfaces. Toe clearance at the side partition is not required in a compartment greater than 66 inches wide.
 - 3. An ambulatory accessible compartment shall be provided where there are six or more toilet compartments, or where the combination of urinals and water closets totals six or more per CBC Section 11B-213.3.1. Such compartment shall comply with CBC Section 11B-604.8.2.
 - 4. Door and door hardware for accessible compartments shall be self-closing and shall comply with CBC Section 11B-404 except that pull-side clearance for ambulatory accessible compartments shall be minimum 44 inches clear, rather than 60 inches. CBC Figure 11B-604.8.2.
 - 5. A door pull complying with CBC Section 11B-404.2.7 shall be placed on both sides of the door near the latch.
 - 6. Doors shall not swing into clear floor space or clearance required for any fixtures or into the minimum compartment area required for ambulatory accessible compartments.

2.2 SOLID-PLASTIC TOILET COMPARTMENTS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Hiny Hiders as manufactured by Scranton Products or comparable product by one of the following:
 - 1. Bradley Corporation; Mills Partitions.
 - 2. Global Steel Products Corp.
 - 3. Hadrian Manufacturing Inc.
 - 4. Knickerbocker Partition Corporation.

- A. Toilet-Enclosure Panel Style: Overhead braced.
- B. Urinal-Screen Style: Wall hung.
- C. Door, Panel, and Pilaster Construction: Solid, high-density polyethylene (HDPE) panel material, not less than 1 inch thick, seamless, with eased edges and with homogenous color and pattern throughout thickness of material.
 - 1. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum strip fastened to exposed bottom edges of solid-plastic components to hinder malicious combustion.
 - 2. Color and Pattern: Hammered Stainless.
- D. Pilaster Shoe and Sleeves (Caps): Manufacturer's standard design; polymer or stainless steel.
 - 1. Polymer Color and Pattern: Matching pilaster.
- E. Brackets (Fittings):
 - 1. Stirrup Type: Manufacturer's standard ear or e-brackets, clear-anodized aluminum.

2.3 HARDWARE AND ACCESSORIES

- A. Hardware and Accessories: Manufacturer's heavy-duty operating hardware and accessories.
 - 1. Hinges: Manufacturer's minimum 0.062-inch- thick stainless-steel, allowing emergency access by lifting door. Mount with through-bolts.
 - 2. Latch and Keeper: Manufacturer's heavy-duty surface-mounted cast-stainless-steel latch unit designed to resist damage due to slamming, with combination rubber-faced door strike and keeper, and with provision for emergency access. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible. Mount with through-bolts.
 - 3. Coat Hook: Manufacturer's heavy-duty combination cast-stainless-steel hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories. Mount with through-bolts.
 - 4. Door Bumper: Manufacturer's heavy-duty rubber-tipped cast-stainless-steel bumper at out-swinging doors. Mount with through-bolts.
 - 5. Door Pull: Manufacturer's heavy-duty cast-stainless-steel pull at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible. Mount with through-bolts.
- B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.
- C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless-steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.4 MATERIALS

- A. Aluminum Castings: ASTM B 26/B 26M.

- B. Aluminum Extrusions: ASTM B 221.
- C. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.
- D. Stainless-Steel Castings: ASTM A 743/A 743M.
- E. Zamac: ASTM B 86, commercial zinc-alloy die castings.

2.5 FABRICATION

- A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.
- B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
 - 1. Confirm location and adequacy of blocking and supports required for installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
 - 1. Maximum Clearances:
 - a. Pilasters and Panels: 1/2 inch.
 - b. Panels and Walls: 1 inch.
 - 1. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel.
 - a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
- B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

- C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.3 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 102113

SECTION 10 28 00

TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Washroom accessories.
2. Warm-air dryers.
3. Underlavatory guards.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:

1. Construction details and dimensions.
2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Material and finish descriptions.
4. Features that will be included for Project.
5. Manufacturer's warranty.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify products using designations indicated.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.6 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.7 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.
- C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- I. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 WASHROOM ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products indicated on Drawings or comparable products by one of the following:
 - 1. Bobrick Washroom Equipment, Inc.
 - 2. Bradley Corporation.

2.3 WARM-AIR DRYERS

- A. Manufacturers: Subject to compliance with requirements, provide products indicated on Drawings or comparable products by one of the following:
 - 1. Bobrick Washroom Equipment, Inc.
 - 2. Bradley Corporation.
 - 3. Excel Dryer Corporation.
 - 4. World Dryer Corporation.

2.4 UNDERLAVATORY GUARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Plumberex Specialty Products, Inc.
 - 2. Truebro by IPS Corporation.

2.5 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

SECTION 10 44 13

FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes fire-protection cabinets for portable fire extinguishers.
- B. Related Requirements:
 - 1. Section 10 44 16 "Fire Extinguishers."

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Owner and Architect to review methods and procedures related to fire protection cabinets including, but not limited to, the following:
 - a. Locations of fire protection cabinets and coordination requirements.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed mounting method and relationships of box and trim to surrounding construction.
- B. Shop Drawings: For fire-protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
- C. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fire protection cabinets to include in maintenance manuals.

1.5 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

1.6 SEQUENCING

- A. Apply decals or vinyl lettering on fire-protection cabinets after painting is complete.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

2.2 FIRE-PROTECTION CABINET

- A. Fire-Protection Cabinets (General): Cabinets must comply with CBC Sections 11B-307, 11B-308, 11B-309 and 11B-403.
- B. Cabinet Type: Suitable for fire extinguisher.
 - 1. Products: Subject to compliance with requirements, provide fire protection cabinets indicate on Drawings, or comparable products by one of the following:
 - a. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - b. Larsen's Manufacturing Company
 - c. Potter Roemer LLC.
- C. Cabinet Construction: Equal to or higher than the rating of the wall in which the cabinet is located.
 - 1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch- thick cold-rolled steel sheet lined with minimum 5/8-inch- thick fire-barrier material. Provide factory-drilled mounting holes.
- D. Cabinet Material: Cold-rolled steel sheet.
- E. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
 - 1. Rolled-Edge Trim: 2-1/2-inch backbend depth.
- F. Cabinet Trim Material: Steel sheet.
- G. Door Material: Steel sheet.
- H. Door Style: As indicated on Drawings.
- I. Door Glazing: Tempered float glass (clear).
- J. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide projecting door pull and friction latches indicated by manufacturer's standard.

2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

K. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.
 - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to location indicated on Drawings.
 - 2) Application Process: Etched, Decals, or pressure-sensitive vinyl letters.
 - 3) Lettering Color: Black.
 - 4) Orientation: Vertical.

L. Materials:

1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
 - a. Finish: Baked enamel or powder coat.
 - b. Color: As selected by Architect from full range of industry colors and color densities.
2. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.3 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
1. Weld joints and grind smooth.
 2. Provide factory-drilled mounting holes.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
 2. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast

PART 3 - EXECUTION

- A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
- C. Identification: Apply decals or vinyl lettering at locations indicated.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

SECTION 10 44 16

FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.
- B. Related Requirements:
 - 1. Section 10 44 13 "Fire Protection Cabinets."

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to fire extinguishers including, but not limited to, the following:
 - a. Schedules and coordination requirements.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
- B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.6 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - b. Larsens Manufacturing Company.
 - c. Nystrom Building Products.
 - d. Potter Roemer LLC.
 - 2. Valves: Manufacturer's standard.
 - 3. Handles and Levers: Manufacturer's standard.
 - 4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.
- B. Wet-Chemical Type (for Kitchen): UL-rated 2-A:1-B:C:K, 2.5-gal. nominal capacity, with potassium acetate-based chemical in stainless-steel container; with pressure-indicating gage.

2.3 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - b. Larsens Manufacturing Company.
 - c. Nystrom, Inc.
 - d. Potter Roemer LLC.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
 1. Mounting Brackets: 44 inches above finished floor to top of fire extinguisher.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION 11 52 13

PROJECTION SCREENS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manually operated projection screens.

B. Related Requirements:

1. Section 05 50 00 "Metal Fabrications" for metal support framing for projection screens.

1.2 DEFINITIONS

- ###### A. Gain: Ratio of light reflected from screen material to that reflected perpendicularly from a magnesium carbonate surface as determined per SMPTE RP 94.

1.3 ACTION SUBMITTALS

- ###### A. Product Data: For each type of product.

- ###### B. Shop Drawings: Show layouts and types of projection screens. Include the following:

1. Drop lengths.
2. Anchorage details, including connection to supporting structure for suspended units.
3. Details of juncture of exposed surfaces with adjacent finishes.
4. Accessories.

- ###### C. Samples for Initial Selection: For finishes of surface-mounted screen cases.

1.4 CLOSEOUT SUBMITTALS

- ###### A. Maintenance Data: For projection screens to include in maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

- ###### A. Environmental Limitations: Do not deliver or install projection screens until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.6 COORDINATION

- A. Coordinate layout and installation of projection screens with adjacent construction, including ceiling suspension systems, light fixtures, HVAC equipment, fire-suppression system, and partitions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Projection Screens: Obtain projection screens from single manufacturer. Obtain accessories, including necessary mounting hardware, from screen manufacturer.

2.2 MANUALLY OPERATED, PROJECTION SCREENS

- A. General: Manufacturer's standard spring-roller-operated units, consisting of case, screen, mounting accessories, and other components necessary for a complete installation.
 - 1. Screen Mounting: Top edge securely anchored to a 3-inch- diameter, rigid steel roller; bottom edge formed into a pocket holding a tubular metal slat, with ends of slat protected by plastic caps, and with a saddle and pull attached to slat by screws.
- A. Surface-Mounted, Metal-Encased, Manually Operated Screens without Tab Tensioning: Units designed and fabricated for surface mounting on wall or ceiling, fabricated from formed-steel sheet not less than 0.027 inch thick or from aluminum extrusions; with flat back design and vinyl covering or baked-enamel finish. Provide units with matching end caps and concealed mounting.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide projection screens manufactured by Da-Lite Screen Company or comparable product by one of the following:
 - a. Bretford, Inc.
 - b. Draper Inc.

2.3 PROJECTION SCREEN MATERIAL

- A. Matte-White Viewing Surface: Peak gain of not less than 0.9, and gain of not less than 0.8 at an angle of 50 degrees from the axis of the screen surface.
- B. Material: Vinyl-coated, glass-fiber fabric.
- C. Mildew-Resistance Rating: Zero or 1 when tested according to ASTM G 21.
- D. Flame Resistance: Passes NFPA 701.
- E. Flame-Spread Index: Not greater than 75 when tested according to ASTM E 84.
- F. Seamless Construction: Provide screens, in sizes indicated, without seams.
- G. Edge Treatment: Without black masking borders.

- H. Size of Viewing Surface: As indicated on Drawings.
- I. Provide extra drop length of dimensions and at locations indicated.
 - 1. Color: Same as viewing surface.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install projection screens at locations indicated to comply with screen manufacturer's written instructions.
- B. Install projection screens with screen cases in position and in relation to adjoining construction indicated. Securely anchor to supporting substrate in a manner that produces a smoothly operating screen with vertical edges plumb and viewing surface flat when screen is lowered.
 - 1. Test manually operated units to verify that screen-operating components are in optimum functioning condition.

END OF SECTION 115213

SECTION 12 24 13

ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

1. Manual and motor-operated roller shades with single rollers.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified.

D. Roller-Shade Schedule: Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of shadeband material, signed by product manufacturer.

C. Product Test Reports: For each type of shadeband material, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roller shades to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Products (RS-1, RS-2 & RS-3): Subject to compliance with requirements, provide products manufactured by MechoShade Systems, Inc. as indicated on Drawings or comparable product by one of the following:
 - 1. Lutron Electronics Co., Inc.
 - 2. Nysan Solar Control Inc.; Hunter Douglas Company.
- B. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

- A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
 - 1. Bead Chains: Manufacturer's standard.

- a. Loop Length: Full length of roller shade.
 - b. Limit Stops: Provide upper and lower ball stops.
- B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
 - 1. Roller Mounting Configuration: Single roller.
 - 2. Roller Drive-End Location: As indicated on Drawings.
 - 3. Direction of Shadeband Roll: Regular, from back of roller.
 - 4. Shadeband-to-Roller Attachment: Manufacturer's standard method.
- C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- D. Shadebands:
 - 1. Shadeband Material: Light-filtering or light-block fabric as indicated.
 - 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
- E. Installation Accessories:
 - 1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
 - a. Shape: As selected from manufacturer's full range.
 - b. Height: Manufacturer's standard height required to conceal roller and shadeband when shade is fully open.
 - 2. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.
 - a. Height: Manufacturer's standard height required to enclose roller and shadeband when shade is fully open, but not less than height indicated on Drawings.
 - 3. Endcap Covers: To cover exposed endcaps.
 - 1. Side Channels: With light seals and designed to eliminate light gaps at sides of shades as shades are drawn down. Provide side channels with shadeband guides or other means of aligning shadebands with channels at tops.
 - 2. Bottom (Sill) Channel or Angle: With light seals and designed to eliminate light gaps at bottoms of shades when shades are closed.
 - 3. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 MOTOR-OPERATED, SINGLE-ROLLER SHADES

- A. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.

1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Electric Motor: Manufacturer's standard tubular, enclosed in roller.
 3. Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush mounting. Provide the following for remote-control activation of shades:
 - a. Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features; isolated from voltage spikes and surges.
 - b. Color: As selected by Architect from manufacturer's full range.
 4. Limit Switches: Adjustable switches interlocked with motor controls and set to stop shades automatically at fully raised and fully lowered positions.
- B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
1. Roller Drive-End Location: As indicated on Drawings.
 2. Direction of Shadeband Roll: Regular, from back of roller.
 3. Shadeband-to-Roller Attachment: Manufacturer's standard method.
- C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- D. Shadebands:
1. Shadeband Material: Light-filtering and light-blocking fabric as indicated.
 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Enclosed in sealed pocket of shadeband material.
- E. Installation Accessories:
1. Recessed Shade Pocket: Rectangular, extruded-aluminum enclosure designed for recessed ceiling installation; with front, top, and back formed as one piece, end plates, and removable bottom closure panel.
 - a. Height: Manufacturer's standard height required to enclose roller and shadeband when shade is fully open, but not less than height indicated on Drawings.
 - b. Provide pocket with lip at lower edge to support acoustical ceiling panel.
 2. Closure Panel and Wall Clip: Removable aluminum panel designed for installation at bottom of site-constructed ceiling recess or pocket and for snap-in attachment to wall clip without fasteners.
 3. Side Channels: With light seals and designed to eliminate light gaps at sides of shades as shades are drawn down. Provide side channels with shadeband guides or other means of aligning shadebands with channels at tops.
 4. Bottom (Sill) Channel or Angle: With light seals and designed to eliminate light gaps at bottoms of shades when shades are closed.
 5. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.4 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Light-Filtering Fabric (RS-1 and RS-2): Woven fabric, stain and fade resistant.
 - 1. Source: Roller-shade manufacturer.
 - 2. Type: As indicated.
 - 3. Orientation on Shadeband: Up the bolt.
 - 4. Openness Factor: As indicated.
 - 5. Color: As indicated.
- C. Light-Blocking Fabric (RS-3): Opaque fabric, stain and fade resistant.
 - 1. Source: Roller-shade manufacturer.
 - 2. Type: As indicated.
 - 1. Orientation on Shadeband: Up the bolt.
 - 2. Features: As indicated.
 - 1. Color: As indicated.

2.5 ROLLER-SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:
 - 1. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
- C. Shadeband Fabrication: Fabricate shadebands without battens or seams.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER-SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units, according to manufacturer's written instructions.

- B. Electrical Connections: Connect motor-operated roller shades to building electrical system.

3.3 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

- A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION 122413

SECTION 13 34 24

PREFABRICATED RAMPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes accessible prefabricated aluminum ramp systems.
- B. Related Requirements:
 - 1. Section 26 05 26 "Grounding and Bonding for Electrical Systems".

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Shop Drawings:
 - 1. Provide shop drawings for each ramp. Include plans, elevations, sections, and details.
 - 2. Provide Division of the State Architect (DSA) approved drawings for the ramps. DSA approved drawings shall include, but not be limited to construction details of ramps, landings, legs, handrails and guardrails.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer shall have a minimum of five years' experience in the production of prefabricated aluminum ramps.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products indicated on Drawings.

2.2 PERFORMANCE REQUIREMENTS

- A. Accessibility Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and CBC.
- B. Grounding: Provide grounding for ramps per Section 26 05 26 "Grounding and Bonding for Electrical Systems".

- C. All components of the ramp system shall be designed so that it can be relocated and re-assembled at another location. It shall also be designed to allow for relocation in another configuration.
- D. Engineering:
 - 1. Ramp and landings shall be designed for a minimum uniform live load of 100-pounds per square foot, and a concentrated vertical load of 300-pounds distributed uniformly over an area of one-square foot.
 - 2. The legs shall be designed to support the ramp and landing.
 - 3. Handrails and Guardrails:
 - a. Handrails and guardrails shall be designed and constructed for a concentrated load of 200-pounds applied at any point in any direction at the top of the handrail or guardrail.
 - b. Handrails and guardrails shall be designed and constructed for a concentrated load of 500-pounds per lineal foot applied horizontally at the required guardrail height and a simultaneous load of 100-pounds per lineal foot applied vertically downward at the top of the guardrail.
 - c. Handrails and guardrails shall be designed and constructed to resist a 200-pound concentrated horizontal load applied over a one-square foot area at any point in the system.

2.3 FABRICATION

- A. Ramps:
 - 1. Ramp sections shall be fabricated in 6 foot or less lengths.
 - 2. Fabrication of lengths other than those indicated above shall be available.
 - 3. Ramp sections shall be designed for a 4-inch minimum to a 48-inch maximum height.
 - 4. Ramp walking surfaces shall have a minimum width of 48-inches inside to inside.
 - 5. Ramp walking surfaces shall be continuous, without gaps, and non-skid in all directions.
 - 6. All ramp sections shall have a wheelchair guard 3-inches plus or minus 1-inch from the deck surface.
- B. Landings:
 - 1. Landings shall be prefabricated to dimensions indicated on Drawings.
 - 2. Landings shall be adjustable from 4-inch minimum to 48-inch maximum height.
 - 3. The walking surface of the landing shall be continuous, without gaps, knurled or cross-hatched, and non-skid in all directions.
- C. Legs:
 - 1. Legs shall telescope into ramps and landings and shall allow for height and slope adjustments. Legs shall be designed to be independent on each side to allow for adjustment without additional foundation systems. Legs shall not protrude outside the footprint of the walking surface.
 - 2. Legs shall be through-bolted per ASTM A307.
 - 3. Legs shall be mounted on 6-inch by 6-inch aluminum pads.
- D. Handrails and Guardrails:

1. Guardrails shall form a 42-inch high protective barrier which will not allow a 4-inch sphere to pass through any opening.
2. All handrails shall be attached to guardrails at 34-inch to 38-inch above walking surface. Handrails shall be continuous, round schedule 40 aluminum pipe (1-1/4-inch to 1-1/2-inch outside diameter) and shall extend no more than 3-1/2-inches into each side of ramp.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions at site. Verify dimensions at areas of installation by field measurements before fabrication. Indicate measurements on Shop Drawings.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prior to delivery and installation of the prefabricated ramps, perform all necessary preparation, including site clearing, grading, paving, and any other Work shown in the Contract Documents and required to be completed prior to delivery.

3.3 INSTALLATION

- A. Install ramps, landings, and handrails rigid, straight, plumb and true. Do not use shims to under legs. Secure prefabricated ramps in position with manufacturer's recommended anchoring devices.

3.4 PROTECTION

- A. Protect ramps, landings, and handrails from damage, abuse, paint, etc. Repair any damage to ramps and landings. Replace units that cannot be repaired to satisfaction of District Construction Manager.

END OF SECTION 133424

SECTION 21 11 19

PRIVATE FIRE MAIN SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. Work includes, but is not necessarily limited to that shown on the approved plans and requirements of this section.
- B. Private site fire water system shall include the following:
 - 1. Connection of private fire main system to lateral(s) at property line(s), as shown on approved plans.
 - 2. Approved backflow prevention assembly or assemblies.
 - 3. All on-site pipe, fittings, valves, hydrants and appurtenances as shown on the approved plans.
 - 4. Location and configurations of fire department connections as approved by responding fire agency.
 - 5. Building system service entry at each riser room.
 - 6. All tests, flushing, inspections and sanitation treatments as required to obtain approval by all authorities having jurisdiction including local fire authority, serving water department and DSA Inspector of Record.
 - 7. Fees, permits, inspections and tests.
 - 8. Meetings and correspondence with project team members and authorities having jurisdiction to confirm specific requirements for this project, including:
 - a. Locations and methods of discharging water from tests and flushing.
 - b. Requirements for pipe and fitting exposure to facilitate visual inspections.
- C. Refer to Section 21 13 13 "Wet-Pipe Fire Sprinkler System" for interior building systems work that is not a part of this section.

1.02 RELATED WORK IN OTHER SECTIONS

- | | |
|--|------------------|
| A. General Requirements | Division 01 |
| B. Wet-Pipe Fire Sprinkler Systems | Section 21 13 13 |
| C. Common Work Results, Plumbing | Section 22 05 00 |
| D. Facility Water Distribution Piping | Section 22 11 13 |
| E. Digital Addressable Fire Alarm System | Section 28 31 11 |

1.03 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Firms regularly engaged in manufacture of listed and/or approved fire protection water system equipment and accessories of types, materials, and sizes required and whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with fire water work similar to that required for project.
- C. Prior to acceptance of the work on private property, obtain/verify acceptance of all work in the public domain from the serving utility and submit copies of the Certificates of Completion to the inspector and owner.

1.04 CODES AND STANDARDS

- A. In addition to complying with all pertinent standards, codes and regulations, comply with all requirements of:
 - 1. California Building Code, 2016 edition.
 - 2. California Fire Code, 2016 edition.
 - 3. State of California, Division of the State Architect.
 - 4. Heartland Fire and Rescue policies and standards.
 - 5. Helix Water District requirements.
 - 6. NFPA 13, 24, 25 and 72 (as adopted by the State of California).
 - 7. Underwriters Laboratories (UL) and FM Global (FM) listed products.
 - 8. American Water Works Association (AWWA) requirements and specifications.
- B. Other Referenced Standards:

Unless otherwise noted on the plans, all work shall conform to the following standard specifications and drawings:

- 1. Standard Specifications:
 - a. Helix Water District Standard Specifications for new construction, current edition.
 - b. San Diego County Design Guidelines and Standards, current edition.
 - c. California Dept. of Transportation, "Manual of Traffic Controls for Construction and Maintenance Work Zones", California MUTCD, 2012 ed.
 - d. Regional Cross-Connection Control and Backflow Prevention Programs.
- 2. Standard Drawings:
 - a. Helix Water District Standard Drawings.
 - b. San Diego Regional Standard Drawings (S.D.R.S.) as Recommended by the Regional Standards Committee, Maintained and Published by the San Diego County Department of Public Works, 2012 edition.

1.05 SUBMITTALS

- A. Submit materials data sheets for all proposed product substitutions from the approved plans and data sheets. Statement of equivalency shall accompany items not exactly comparable to the approved product. Substitution of backflow assemblies shall only be allowed if submitted to and approved by DSA Fire Life Safety review with hydraulic calculations for any additional pressure loss. Substitutions shall be at the contractor's risk, and at no additional expense to the owner.

- B. Record Drawings: At project closeout, submit record drawings of installed fire water system piping and products, in accordance with requirements of Division 1.
- C. Maintenance Data: Submit maintenance data and parts lists for fire water system materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual; in accordance with requirements of Division 01

1.06 PROJECT CONDITIONS

- A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by District or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:
 - 1. Notify Owner or Construction Manager no fewer than five days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of water-distribution service without Owner or Construction Manager's written permission.

PART 2 – PRODUCTS

2.01 IDENTIFICATION

- A. Underground-Type Plastic Line Marker: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 3" wide x 4 mils thick. Provide tape with printing reading "CAUTION BURIED WATER LINE BELOW" (or similar language).

2.02 PIPE AND PIPE FITTINGS – GENERAL

- A. Provide ells, tees, reducing tees, couplings, and other required piping accessories of same type and class of material as conduit, or of material having equal or superior physical and chemical properties as acceptable to Owner's Architect/Engineer and Inspector.
- B. Joints for pipe shall be push-on joints as specified in ASTM D 3139. Joints between pipe and metal fittings, valves, and other accessories shall be push-on joints as specified in ASTM D 3139, or shall be compression-type joints/mechanical-joints as respectively specified in ASTM D 3139 and AWWA C111. Each joint connection shall be provided with an elastomeric gasket suitable for the bell or coupling with which it is to be used.
 - 1. Gaskets for push-on joints and compression-type joints/mechanical-joints for joint connections between pipes and metal fittings, valves, and other accessories shall be as specified in AWWA C111 respectively for push-on joints and mechanical-joints.
 - 2. Mechanically coupled joints, using a sleeve-type mechanical coupling, may be used as an optional jointing method in lieu of push-on joints on plain-end PVC plastic pipe.

2.03 COPPER TUBE AND FITTINGS

- A. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.
 - 1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
- B. Hard Copper Tube: ASTM B 88, Type K or Type L, water tube, drawn temper.

1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

C. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.

D. 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.

2.04 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.

1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.

1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

2. Gaskets: AWWA C111, rubber.

C. Flanges: ASME 16.1, Class 125, cast iron.

2.05 PVC PIPE AND FITTINGS

A. PVC, AWWA Pipe: AWWA C900 bell end with gasket and with spigot end, Pressure Class 150/235 (DR 18) with cast-iron-pipe-equivalent OD. Where pressures may exceed 175 PSI, pipe shall be Pressure Class 200/305 (DR 14).

1. Comply with UL 1285 for fire-service mains as applicable and/or required.

2. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

- a. Gaskets: AWWA C111, rubber.

3. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

- a. Gaskets: AWWA C111, rubber.

2.06 POLYETHYLENE PIPE AND FITTINGS

A. PE, ASTM Pipe: ASTM D 2239, SDR No. 5.3, 7, or 9; with PE compound number required to give pressure rating not less than 160 psig.

1. Insert Fittings for PE Pipe: ASTM D 2609, made of PA, PP, or PVC with serrated male insert ends matching inside of pipe. Include bands or crimp rings.

2. Molded PE Fittings: ASTM D 3350, PE resin, socket- or butt-fusion type, made to match PE pipe dimensions and class.
 - B. PE, AWWA Pipe: AWWA C906, DR No. 7.3, 9, or 9.3; with PE compound number required to give pressure rating not less than 200 psig.
 1. PE, AWWA Fittings: AWWA C906, socket- or butt-fusion type, with DR number matching pipe and PE compound number required to give pressure rating not less than 200 psig.
 - C. PE, Fire-Service Pipe: ASTM F 714, AWWA C906, or equivalent for PE water pipe; FMG approved, with minimum thickness equivalent to FMG Class 200.
 1. Molded PE Fittings: ASTM D 3350, PE resin, socket- or butt-fusion type, made to match PE pipe dimensions and class.
- 2.07 CHLORINATED POLYVINYL CHLORIDE FIRE PROTECTION PIPE AND FITTINGS
- A. CPVC, listed for fire protection per UL 1821.
 1. LISTED FOR FIRE PROTECTION SERVICE
- 2.08 TRANSITION FITTINGS
- A. One-piece riser sweep, 90° fabricated 304 stainless steel.
 1. UL and/or FM approved for fire protection services.
 2. Working pressure rating 200 PSI minimum, equivalent to DR 14.
 3. Vertical end per AWWA C606 for roll groove and C-207 for flanged pipe.
 4. Horizontal end per AWWA C900 and standard ductile iron pipe diameters with UL 157 gasket.
- 2.09 GATE VALVES
- A. Provide flanged or mechanical joint gate valves, listed for fire protection service, 175 psi working pressure for 12" and smaller, 150 psi for sizes larger than 12".
 1. Non-rising-Stem, Resilient-Seated Gate Valves
 - a. Description: Ductile-iron body and bonnet; with bronze gate, resilient seats, bronze stem, and stem nut.
 - b. Standard: AWWA C509. Minimum Pressure Rating: 250 psig.
 - c. End Connections: Push on or mechanical joint.
 - d. Interior Coating: Complying with AWWA C550.
 2. OS&Y, Rising-Stem Gate Valves
 - a. Description: Ductile-iron body and bonnet, with bronze gate, resilient seats, and bronze stem.
 - b. UL 262, FM approved. Minimum Pressure Rating: 175 psig.
 - c. End Connections: Flanged.
 - B. Indicator Posts: UL 789, FM approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve. Post shall be listed for use with specific make/model of gate valve.

- C. Valve Box and Cap: Telescopic barrel type for use with underground gate valves, cap is to be cast iron and marked "WATER".

2.10 BACKFLOW PREVENTION ASSEMBLY

- A. Backflow preventer assembly shall be installed strictly per all requirements and standard drawings of serving water authority. Assembly shall be Reduced Pressure Detector Assembly (RPDA) with bypass and meter as required.
- B. Any proposed assembly shall be U.L. classified and/or FM approved for fire protection service and shall be listed by the Foundation for Cross-Connection Control and Hydraulic Research at the University of Southern California.) Verify exact make and model of appliance with serving water authority.

2.11 CHECK VALVES

- A. Check valves shall be iron body, bronze mounted, horizontal swing check. As acceptable to authorities having jurisdiction, iron body, bronze, disk wafer check may be used.
- B. Check valve shall be U.L./F.M. approved for fire protection use, and recommended by the manufacturer for direct bury where such installation is to be required.
 - 1. Where check valve is installed underground, an approved valve box or other means of accessing the valve for inspections and testing shall be furnished and installed.
- C. Iron body, bronze disk threaded or grooved swing check may be installed at Fire Department Connection, and located as acceptable to serving fire department.

2.12 FIRE HYDRANTS

- A. General: Hydrants shall conform to serving fire department requirements. Number of hydrants, spacing and proximity to fire apparatus lanes shall be in accordance with approved plans.
- B. Hydrants shall be wet-barrel type except where subject to freezing.
- C. Hydrants shall be furnished with National Standard (fire hose) Threads (NST). Unless noted otherwise there shall be two 4" and one 2½" ports, individually valved and equipped with caps and chains.

2.13 FIRE DEPARTMENT CONNECTIONS

- A. Furnish 4" x 2 1/2" two-way, Siamese fire department connection. Finish and model shall be in conformance with serving fire department requirements. Provide check valve per Section 2.11.
- B. Fire department connection piping shall be ductile iron, with corrosion protection as specified in this section. No steel piping shall be installed at fire department connections.

2.14 ANCHORAGES

- A. General: Provide anchorages for ells, tees, crosses, plugs, caps, bends, valves, and hydrants. After installation, apply full coat of asphalt or other acceptable corrosion-retarding material to surfaces of ferrous anchorages.
 - 1. Clamps, Straps and Washers: Steel, ASTM A 506.

2. Rods: Steel, ASTM A 575.
3. Rod Couplings: Malleable-iron, ASTM A 197.
4. Bolts: Steel, ASTM A 307.
5. Cast-Iron Washers: Gray-iron, ASTM A 126.
6. Thrust Blocks: Concrete, minimum 2,500 psi.

2.15 CORROSION PROTECTION

A. Encasement for Underground Metal Piping:

1. Standards: ASTM A 674 or AWWA C105.
2. Form: Sheet or tube.
3. Material: LLDPE film of 0.008-inch minimum thickness.
4. Material: LLDPE film of 0.008-inch minimum thickness, or high-density, cross-laminated PE film of 0.004-inch minimum thickness.
5. Material: High-density, cross-laminated PE film of 0.004-inch minimum thickness.
6. Color: Black.

B. Dielectric Fittings

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined
2. Dielectric Unions
 - a. Standard: ASSE 1079.
 - b. Pressure Rating: 250 psig.
 - c. End Connections: Solder-joint copper alloy and threaded ferrous.
3. Dielectric Flanges
 - a. Standard: ASSE 1079.
 - b. Factory-fabricated, bolted, companion-flange assembly.
 - c. Pressure Rating: 150 psig or 300 psig.
 - d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
4. Dielectric Flange Insulating Kits
 - a. Field-assembled companion-flange assembly, full face or ring type.
 - b. Non-conducting materials for field assembly of companion flanges.
 - c. Pressure Rating: 150 psig or 300 psig.
 - d. Gasket: Neoprene or phenolic.
 - e. Bolt Sleeves: Phenolic or polyethylene.
 - f. Washers: Phenolic with steel backing washers.
5. Dielectric Couplings

- a. Galvanized steel couplings with inert and noncorrosive thermoplastic lining, with threaded ends.
- b. Pressure Rating: 300 psig.
- 6. Dielectric Nipples
 - a. Standard: IAPMO PS 66.
 - b. Electroplated steel nipple complying with ASTM F 1545.
 - c. Pressure Rating: 300 psig at 225 deg F minimum.
 - d. End Connections: Male threaded or grooved.
 - e. Lining: Inert and noncorrosive, propylene.

2.16 ELECTRONIC SUPERVISION

- A. Furnish valve supervision, as required by authorities having jurisdiction, at all valves controlling fire protection water supplies, and any required underground conduit thereto.
- B. Provide UL/FM approved tamper switch, Model PIVSU-A1, or OSYSU-A1, or UL/FM listed equivalent, 12 or 24 VDC or 120VAC with one set of Form C, single pole, double-throw contacts.
- C. Tamper connections shall be furnished and zoned as required by serving fire department.
- D. Signals shall be monitored at local fire alarm panel and central station as required and as shown on fire alarm plans.

PART 3 – EXECUTION

3.01 INSTALLATION OF IDENTIFICATION

- A. General: During back-filling/top-soiling of underground fire water piping systems, install continuous underground-type plastic line marker, located directly over buried line at 6" to 8" below finished subgrade, but at least 6" above the top of pipe.

3.02 INSTALLATION OF PIPE AND PIPE FITTINGS

- A. General: Install exterior fire water systems in compliance with applicable provisions of NFPA 24 and the Standard Specifications for Public Works Construction.
- B. Polyvinyl Chloride Pipe: Install in accordance with manufacturer's installation instructions.
- C. Depth of Cover: Provide three (3) foot minimum depth of cover over underground piping.
- D. Transition from underground to interior building system the passes under footings and on-grade slab shall utilize a one-piece riser sweep.
 - 1. Pipe and fittings shall be installed so that no mechanical joints are located below structural footing or slab on grade.
 - 2. All penetrations of floors and walls shall maintain minimum 2" annular clearance around entire circumference of piping.
 - 3. All piping shall be restrained using mechanical joint fittings, rods and/or thrust blocks.
 - 4. All pipe and fittings shall be protected from corrosion as specified in this section.

3.03 INSTALLATION OF VALVES

- A. General: Install valves as indicated. Provide post indicator for control valves where shown on plans.

- B. Control Valves: Install post indicator valve at each connection into building, locate 40' from building outside wall, or as shown on approved plans.
- C. Shutoff Valves: Install shutoff valve ahead of each hydrant.

3.04 CONCRETE PADS

- A. As required by serving fire and/or water department, furnish concrete pads under all fire hydrants, backflow prevention assemblies and fire service valve assemblies per standard drawings and details.
 - 1. Where pipe, fittings and devices are installed in the horizontal position, furnish approved pipe stands or other means of support.

3.05 SIGNAGE

- A. Provide signage as required by serving fire department to identify all fire protection system valves and fire department inlet connections. Signs shall be building and system specific and shall be constructed of durable, weather-resistant materials and shall be finished or coated or otherwise protected as required to prevent damage and fading from ultra-violet light.
 - 1. As required by serving fire authority, signage shall be affixed to valves and inlet connections using lightweight chain with zinc or galvanized finish.
 - 2. Lettering shall be of the minimum size and color required by serving fire department.
 - 3. Where required, signage shall be installed on posts and elevated above finished grade.

3.06 FIELD QUALITY CONTROL

- A. Piping Tests: Conduct piping tests before joints are covered, and after thrust blocks have sufficiently hardened. Fill pipeline with water 24-hrs prior to testing, and apply test pressure to stabilize system.
- B. Hydrostatic Tests: Test at not less than 200 psi for 2 hours, or at 50 psi above maximum static pressure where greater than 150 psi.
 - 1. Test shall be considered a fail if leakage exceeds allowable as prescribed in NFPA 24, or as required by authorities having jurisdiction.
 - 2. Increase pressure in 50 psi increments and inspect each joint between increments. Hold at test pressure for one hour, decrease to 0 psi. Slowly increase again to test pressure and hold for one more hour.
- C. Upon acceptance of hydrostatic testing by DSA Inspector of Record, the entire fire main system shall be flushed in accordance with the procedures described in NFPA 24. Flow rates shall be as required by NFPA 24, or at the hydraulically calculated water demand rate of the system, whichever is greater.
 - 1. Erosion and storm drain controls, conformance to local best practices and the collection/treatment of discharge as required shall be the responsibility of this contractor.
- D. Operating Tests: Open and close all valves and hydrants under system water pressure. Order required operational tests by serving Fire and Water Departments.

3.07 COMPLETION

- A. Closeout

1. Upon completion and approval of system, and prior to occupancy, provide instruction to the Owner, or Owner's representative, in all details of system operation and maintenance. Prepare and submit maintenance and operation manual per other sections of specifications as applicable.
2. Provide three copies of final inspection and certification as prescribed by Owner's Insurance Underwriter, and other authorities having jurisdiction.
3. Furnish fully executed NFPA Materials and Test Certificate to Owner or Owner's representative, local fire authority, architect and to DSA Inspector of Record.
4. Submit two copies of guarantee per Division 01.
5. Provide three (3) copies of system "As-Built" drawings to the Owner or Owner's representative. Drawings shall show actual installation details including all piping and equipment locations, room or facilities modifications, etc. One (1) copy of drawings shall be on reproducible type media.

B. Clean Up

1. Equipment, appurtenances, fixtures and exposed piping shall be clean, and all excess dope and oil shall be removed. Sprinkler heads shall be cleaned without the use of any solvents.
2. Upon completion of work, remove all surplus material, debris, and equipment associated with or used in the execution of this work. Sweep work and storage areas, as required, to remove metal shavings and oily residue.

END OF SECTION

SECTION 21 13 13

WET-PIPE FIRE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION

Work includes, but is not necessarily limited to, the following work areas:

1. Installation of a complete wet-pipe automatic fire sprinkler systems in all buildings shown on plans including all interior compartments, exterior soffits (where required) and combustible concealed spaces if any.
2. Compilation of record drawings by installing contractor, including all field changes and installing contractor's C-16 license number.
3. Connection of interior fire sprinkler systems to site fire service laterals, at points of connection shown on fire protection and civil site plans.
4. Test valves, drain lines, and all other inspection components.
5. All coring, drilling, sleeving and chasing required for piping installation, as approved by Architect and Structural.
6. Local audible alarm and connection points for central station monitoring, as shown on plans and as specified.
7. Fees, permits, inspections and tests.
8. Meetings and correspondence with project team members to confirm specific requirements for this project, including:
 - a. Location and methods of discharging water from test and drain connections.
 - b. Zoning and signaling requirements for alarm, detection and monitoring systems.

1.02 RELATED WORK IN OTHER SECTIONS

A. General Requirements	Division 01
B. Exterior Painting	Section 09 91 13
C. Interior Painting	Section 09 91 23
D. Private Site Fire Main System	Section 21 11 19
E. Sanitary Waste and Vent Piping	Section 22 19 19
F. Fire Detection and Alarm System	Section 28 31 11

1.03 QUALITY ASSURANCE

- A. Qualifications of Fabricators and Installers
 1. For actual fabrication and installation of sprinkler systems, use only personnel who are thoroughly trained and experienced with the products involved, and in the recommended methods of their installation.
 2. Installing contractor shall have a California C-16 license and be experienced in design and installation of systems in projects of similar size and scope.

1.04 REFERENCES

- A. In addition to complying with all pertinent standards, codes and regulations, comply with all requirements of:
 - 1. California Building Code, 2016 edition.
 - 2. California Fire Code, 2016 edition.
 - 3. State of California, Division of the State Architect.
 - 4. Heartland Fire/Rescue District requirements.
 - 5. Helix Water District requirements
 - 6. NFPA 13, 24, 25 and 72 (as adopted by the State of California).
 - 7. Underwriters Laboratories (UL) and FM Global (FM) listed products.
 - 8. ICC Evaluation Service listed products.

1.05 SUBMITTALS

A. Shop Drawings

- 1. Within 30 days after award of Contract, submit shop drawings to the Architect for review. A complete submittal shall include the following:
 - a. Shop drawings shall be in compliance with approved plans.
 - b. Location of all switches, bells and electrical connections for alarm system, as described in this specification.
 - c. Location of connections to drain receptors for test and drain discharge.
 - d. Where revisions are proposed due to coordination with work of other trades, they shall be clearly illustrated and called out for review.
 - e. Where value-engineered revisions are proposed, they shall be clearly illustrated and called out for review.
 - f. Notations and identifying marks for fabrication may be included.
- 2. Submit materials data sheets for all proposed product substitutions from the approved plans and data sheets. A statement of equivalency shall accompany items that are not exactly comparable to the approved product. Proposed substitutions of hanger and bracing materials shall only be allowed if submitted to and approved by DSA Fire Life Safety and Structural review with all required calculations and written acceptance by project structural engineer. Such substitutions shall be at the contractor's risk and at no additional expense to the owner.

B. Maintenance Manual

- 1. At close-out, submit maintenance manual describing maintenance schedules, replacement parts, and operational requirements.

C. Guarantee

- 1. Contractor shall guarantee fixed fire protection system, for a period of two years after date of final inspection, from leaks and other failures from materials and workmanship. Guarantee shall include repair of damage to Owner.

1.06 COORDINATION

- A. Coordinate work with that specified in other sections before start of installation. Any installation found to be in conflict with other trades due to neglected coordination, shall be removed and reinstalled as directed by the Architect at no additional expense to the Owner.
- B. Contractor shall contact the Fire Protection Design Firm & Architect to obtain necessary information to fit into allotted spaces without interfering with work by other trades.
- C. Coordinate with Plumbing section for size and location of drain receptors, where required or shown for draining and testing fire sprinkler risers and systems. All drain piping shall discharge into the receptors and not through walls or curbs, unless noted otherwise.
- D. Deviation from the approved plans shall require permission of the Division of the State Architect.

PART 2 - DESIGN AND MATERIALS

2.01 GENERAL DESIGN CRITERIA

- A. COVERAGE AND SCOPE
 - 1. Storage, workshop, utility rooms, maintenance and custodial areas shall be protected for Ordinary Hazard. Sprinklers shall be spaced at a maximum coverage of 130 sq. ft. for standard spray sprinklers.
 - 2. All other areas shall be protected for Light Hazard. Sprinklers shall be spaced at a maximum coverage of 225 sq. ft. for standard spray sprinklers or as shown on plans for sidewall or extended coverage sprinklers.
- B. System shall be designed using point of connection as shown on drawings, and as described in this specification.

2.02 MATERIALS AND PRODUCTS – GENERAL

- A. All material installed shall be approved and/or listed for fire protection use by the referenced authorities, codes and standards. All material shall be new and without field modifications.

2.03 SPRINKLERS

- A. General
 - 1. All sprinklers shall be of similar make and appearance and shall have the same bulb or link and finish except where otherwise required by exposure to heat sources, freezing temperatures, corrosive environment, etc.
- B. Interior Finished Ceilings and Exterior Soffits

1. Provide recessed standard spray pendent, with white polyester finish and matching escutcheon.
2. Listed corrosion-resistant sprinklers shall be installed at exterior areas, with white polyester or Teflon finish and matching escutcheon.

C. Concealed Areas, Unfinished Ceilings, and Service Areas

1. Provide standard spray upright or pendent, with white finish.
2. Where required, escutcheons shall be two-piece, style #401 with white painted finish at areas with ceilings.

D. Temperature Ratings and Response Type

1. Sprinklers below finished ceilings, and in all other occupied areas shall have a temperature rating of Ordinary (155-165° F), except as noted below.
 - a. Sprinklers in unventilated spaces and under exterior canopies shall have a temperature rating of Intermediate (200-212° F).
 - b. Sprinklers in zone of influence of space heaters or other heat-producing equipment shall have a temperature rating of High (250-300° F), unless otherwise required by code.
 - c. All sprinklers shall be listed, quick-response type.

2.04 HANGERS AND SUPPORTS

A. General

1. Provide hangers approved by UL/FM and NFPA 13 for fire sprinkler systems. Shop fabricated supports shall be designed to meet requirements of NFPA 13, and must be certified by a registered professional engineer.
2. Provide earthquake bracing in accordance with UL/FM, NFPA 13 and ASCE 7. Locations of all bracing shall be shown on shop drawings in conformance with approved plans. All bracing shall be assembled and installed per NFPA 13 and manufacturer's installation instructions.
3. Size all anchors and fasteners per NFPA 13. All lag screws, bolts and drive screws shall be installed as required by codes and accepted good practices.
4. All fasteners and/or anchors proposed for use in concrete construction shall be specifically listed and approved for use on fire sprinkler systems in seismic zones. Powder-driven studs shall not be used unless all system components including installation tool and pins are listed.

2.05 INTERIOR SPRINKLER PIPE AND FITTINGS

A. General

1. All pipe and fittings shall be new, acceptable to authorities having jurisdiction, per all applicable standards and codes, and free from damage and distortion.

B. Product Characteristics

1. Black steel, Schedule 40, ASTM A-53/135/795, for all piping, with threaded joints and fittings.
2. Black steel, Schedule 10, ASTM A-53/135/795, for all piping, with non-threaded joints and fittings.
3. Threaded fittings shall be of cast or malleable iron, class 125 or 150, conforming to ANSI B16.3 and ANSI B16.4.
4. Flanged fittings shall be provided where required. Flanges shall be of cast iron, class 125, conforming to ANSI B16.1.
5. Welded fittings shall be of wrought steel, conforming to ANSI B16.9.
6. One-piece reducing fittings shall be used wherever a change is made in pipe size. Bushings shall not be used, except where fittings of the required size are not available.
7. Grooved thinwall steel pipe connections shall be made using a UL/FM approved ductile iron coupling, with rubber gasket. Installation shall be per manufacturer's instructions.
8. All piping shall be joined with welded, threaded or grooved fittings. Fittings for hole-cut connections are not acceptable.

2.06 ACCESSORY CABINET

- A. Furnish metal sprinkler cabinet in riser room, with reserve supply of sprinklers as required by NFPA 13. Include one suitable head wrench for each type of sprinkler installed. Stock shall include all types and temperature ratings.

2.07 SIGNS

- A. Provide metal signage permanently marked to show function, for all valves, controls and related assemblies. Locate as required by NFPA 13 and authorities having jurisdiction. Where signs are required to identify valves or assemblies in hidden or void spaces, locate as directed by Architect.

2.08 PROTECTION OF SPRINKLERS

- A. Provide UL/FM listed guards for sprinkler heads located in areas susceptible to mechanical damage.

2.09 ESCUTCHEON PLATES

- A. Provide chrome-plated escutcheons where exposed piping penetrations are made through finished walls and ceilings. Plates shall be painted to resist corrosion when exterior installation is required.

2.10 LOCAL ALARM COMPONENTS

A. Exterior Alarm Bell

1. Furnish 10" diameter, UL/FM approved bell with identification sign, rated 120VAC, with standard mounting hardware.
2. Locate as shown on approved plans.

B. Water Flow Switch

1. Provide UL/FM approved, 120VAC with two sets of Form C, single pole, double throw contacts, and adjustable retard feature.
2. Retard shall be set by Contractor so as to prevent false alarms, and still allow audible alarm within 30 seconds.

2.11 CENTRAL STATION SUPERVISION

A. General

1. Furnish supervision at all valves controlling fire protection water supplies, and any required underground conduit thereto.
2. Provide UL/FM approved tamper switch, Model PCVS-1, or OSYSU-1, or UL/FM listed equivalent, 120VAC with one set of Form C, single-pole, double-throw contacts.

2.12 FIRE DEPARTMENT CONNECTION

- A. Provide 4 " x 2 ½", single or double clapper 2-way fire department connection. Finish and model shall be as required by serving fire department. Provide check valve per Section 2.13.B.

2.13 VALVE COMPONENTS

A. Control Valve

1. Provide iron, double disc, bronze-mounted gate valve, with adjustable indicator post.
2. Post shall be compatible with valve, and be field painted as required by serving fire department.

B. Backflow Prevention and Check Valves

1. Check valves shall be iron body, bronze mounted, horizontal swing check. As acceptable to authorities having jurisdiction, iron body, bronze, disk wafer check may be used.
2. Check valve shall be U.L/FM approved for fire protection use, and recommended by the manufacturer for direct bury where such installation is to be required.
Iron body, bronze disk threaded or grooved swing check may be installed at Fire Department Connection, and located as acceptable to serving fire department.

C. Interior Drain/Test Valves

1. Furnish listed combination test and drain valve at riser, as shown on the approved plans. Provide pressure relief type, with bypass.
2. Where auxiliary drainage is required, provide brass, rubber disc, angle or globe pattern, with screwed ends, rated 200psi WOG.

2.14 VALVE CHART

- A. Provide chart in enclosed frame, indicating all valve locations functions.

2.15 UNDERGROUND PIPE AND FITTINGS

A. General

1. All pipe and fittings shall be new, acceptable to authorities having jurisdiction, comply with all applicable standards and codes, and free from damage and distortion.

B. Product Characteristics

1. Pipe shall be cast or ductile iron, or C-900 PVC, as shown on plans or required by water department. Pipe under structural footings shall be cast or ductile iron only, to at least 5'-0" beyond outside face of building.
2. Fittings shall be ductile iron, class 250, flanged or mechanical joints as required. Proper thrust restraint shall be provided per NFPA 24.
3. All hardware installed below-grade, including studs, bolts, nuts, washers, thrust-restraint rods, etc. shall be stainless steel conforming to UNS 31600 (formerly AISI Type 316). Hex-head bolts shall conform to ASTM F593, Alloy Group 2, Condition CW1/CW2 (depending on size). Hex nuts shall conform to ASTM F594, Alloy Group 2, Condition CW1/CW2 (depending on size). T-bolts shall be stamped to show conformance with UNS 31600.

PART 3 - EXECUTION

3.01 JOB SITE CONDITIONS

A. Inspection

1. Prior to all work of this section carefully inspect the installed work of other sections, and verify that all such work is complete to the point where this portion of the work may properly commence in accordance with all submittals, designs, and applicable codes.

B. Discrepancies

1. In the event of a discrepancy, immediately notify the Architect. Do not proceed with installation in areas of discrepancy until all such discrepancies and/or omissions have been fully reviewed and clarified.

3.02 FABRICATION

A. General

1. All pipe, fittings, and materials shall be prepared by qualified personnel, trained and experienced with the products involved, and the recommended methods of preparation.
2. All pipe cuts, threads, and grooves shall be made according to applicable codes, standards and accepted good practices.
3. Pipe shall be free of damage, flaws and burrs. Threads and grooves shall not be excessively shallow or deep.
4. Fittings shall be made onto the pipe no tighter than necessary. Cracked or broken fittings shall be replaced, without exception.
5. Excess dope and oils shall be removed before shipment to job site.

B. Welding

1. Welding methods shall comply with NFPA 13 and AWS B2.1. Contractor shall be responsible for all welded joints and any qualifying procedures for welders and related personnel.
2. Holes in pipe for outlets shall be cut to full inside diameter of fitting, prior to welding in place. Holes shall be free of slag and welding residue and of smooth bore. Fittings shall not penetrate internal diameter of run piping. Holes shall be cut by hole-saw or other rotary bit. Torch-cutting of holes is prohibited.

3.03 INSTALLATION

A. General

1. All installations shall be per referenced standards. Follow manufacturer's directions and recommendations in all cases as required for all approvals and warranty enforcement.
2. All cutting of structure shall be subject to approval by the Architect. Beams, decks and other structural components shall not be cut or altered in any way unless previously approved.
3. Provide flexible couplings where required to provide expansion capability, and for earthquake protection per NFPA 13. Provide sway bracing as required by coupling locations.
4. Entire sprinkler system shall be installed in such a manner so that it can be drained in accordance with NFPA 13. Drains shall be located at suitable points as approved by Architect. No primary or auxiliary drain shall be located in any public area or electrical room. All drains shall discharge into dedicated receptors.
5. No work shall be covered or enclosed until inspected, tested, and approved by Architect and/or authority having jurisdiction. Should any work be concealed before inspection, the Contractor shall, at Contractor's expense, uncover such work and after it has been inspected, tested and approved, provide for all repairs as may be necessary to restore work to original and proper condition.
6. Sprinklers at finished ceilings and in exposed locations shall form a symmetrical pattern and shall be located at the exact centerline of 2' square ceiling tiles and "Second Look" tile modules. Where 2' x 4' ceilings occur, sprinklers shall be centered in the 2' direction with escutcheons at least 6" clear of ceiling T-bars.
7. Sprinkler layout shall accommodate lighting and HVAC register locations. Coordination with the work of these sections is the responsibility of Contractor.
8. Without exception, no piping shall be run under or through any skylight or skylight well. Any additional upright or pendent sprinklers, which may be required by skylight locations, shall be the responsibility of this contractor.
9. All penetrations of wall and floor assemblies shall be suitably sleeved, patched and/or sealed in order to preserve fire rating, where applicable.
10. Location of control valves, fire department connection, and inspector's test shall be as required by authorities having jurisdiction, and as approved by Architect.

11. Local alarm bells shall be located so as to be easily heard and seen by passersby and fire department personnel. Locate on exterior wall, 10'-0" – 12'-0" above finished grade.
12. Provide wood or metal floor pans under and around pipe cutting/threading machines to protect floor surfaces from damage and discoloration.
13. Paint all fire sprinkler piping risers, drops and other components exposed to view in final construction as directed by Architect and per Section 09 91 23.
14. Underground pipe and fittings shall be installed per NFPA 24, and applicable local codes and standards. Trenching, back-filling, depth of bury and size, shape and location of all thrust blocks shall be acceptable to all jurisdictional agencies.

3.04 FIELD QUALITY CONTROL

A. Testing

1. Perform all tests as required by NFPA 13, and all authorities having jurisdiction. Maintain an accurate record of all tests and inspections on the job site, including date of test and inspecting agency.
2. Before connection of interior system to underground main, underground piping shall be hydrostatically tested, flushed and accepted by authorities having jurisdiction. Provide documentation of acceptance by jurisdictional authority. All required health and bacterial tests shall be the responsibility of Contractor.

3.05 COMPLETION

A. Closeout

1. Upon completion and approval of system, and prior to occupancy, provide instruction to the Owner, or Owner's representative, in all details of system operation and maintenance. Prepare and submit maintenance and operation manual per other sections of specifications as applicable.
2. Provide three copies of final inspection and certification as prescribed by Owner's Insurance Underwriter, and other authorities having jurisdiction.
3. Provide three (3) copies of system "As-Built" drawings to the Owner or Owner's representative. Drawings shall show actual installation details including all piping and equipment locations, room or facilities modifications, etc. One (1) copy of drawings shall be on reproducible type media.
4. Furnish fully executed NFPA Materials and Test Certificate.
5. Submit two copies of guarantee per Section 01 78 39.

B. Clean Up

1. Equipment, appurtenances, fixtures and exposed piping shall be clean, and all excess dope and oil shall be removed. Sprinkler heads shall be cleaned without the use of any solvents.
2. Upon completion of work, remove all surplus material, debris, and equipment associated with or used in the execution of this work. Sweep work and storage areas, as required, to remove metal shavings and oily residue.

END OF SECTION

SECTION 22 01 00

PLUMBING GENERAL PROVISIONS

Note to Engineers:

All fixtures and equipment must be shown on the drawings in a fixture/equipment schedule. Refer to the Material Standards for Fixtures/Equipment.

PART 1 - GENERAL

1.01 SUMMARY

- A. Provide items, articles, materials, operations and methods listed, mentioned and scheduled on drawing and specifications, including labor, material, equipment or fixtures, and incidentals necessary or required for the completion, testing, inspection, adjusting, re-testing and readjusting to provide the various systems operable and complete in all respects.
- B. Provide fixtures and equipment which have been listed in the Material Standards by Grossmont Union High School District (GUHSD).

1.02 RELATED SECTIONS

- A. Section 22 07 00 Plumbing Insulation
- B. Section 22 20 00 Plumbing Systems

1.03 DRAWINGS AND SPECIFICATIONS

- A. Examine and become familiar with all project drawings and sections of the specifications, and coordinate the work accordingly. Make reasonable modifications in the layout and installation as needed to prevent conflict with work of other trades and for proper execution of the work, without additional cost.
- B. The drawings indicate approximate locations of equipment, fixtures, piping, etc., however, prior to ordering any equipment, fixtures or materials, or performing any work, all dimensions, locations, and clearances shall be verified by the Contractor, based on actual field conditions, following the necessary coordination with other trades.
- C. The substitutions of equipment or fixtures may not be the same as that which was used as a basis for design. The term substitutions only refers to items listed in our specification that are not used as the basis of design on our drawings. Provide all necessary revisions to the installation, or work of all other trades to accommodate the substituted equipment or fixtures, maintaining comparable clearances and provisions for maintenance shall be provided, with all related costs, by the Contractor. Submit substituted working drawings and submittals that have been coordinated with all other associated trades, showing the proposed installation.
- D. It is the intention of the specifications and drawings to call for finished work, tested and ready for operation.
- E. Where any device or part of equipment or fixtures is herein referred to in the singular number, such reference shall be deemed to apply to as many such devices as are required to complete the installation or as shown.

1.04 SUBMITTALS - SHOP DRAWINGS/PRODUCT DATA/MATERIAL CERTIFICATIONS

- A. Submittals shall include six copies of all shop drawings, product data and material certifications for the project. These submittals shall be sent to the GUHSD Representative.
- B. GUHSD Representative will review the shop drawings, product data and material certifications for the project. Do not fabricate pipe or order any equipment or fixtures without shop drawings and product data being approved. All pipe systems, equipment, fixtures and other accessories require submittal review.
- C. Shop drawings, product data and material certifications shall be complete in every respect so that a thorough review and evaluation can be performed. All required shop drawings, product data and material certifications shall be submitted at one time. Incomplete submittals, those without shop drawings, those that are not prepared properly, or submittals with less than the required number of copies, shall be returned for resubmittal.
- D. It is intended that only a one-time review of all shop drawings and submittals will be performed.
- E. All shop drawings, product data and samples submitted by the Contractor shall illustrate details of work, equipment, fixtures, materials, products, systems, designs or workmanship that the Contractor intends to use in order to comply with the design concept established in the contract documents. The review of these submittals is only for the limited purpose of checking the same for conformity with the design concept of the work as established in the contract documents. The review is not intended to be for the purpose of determining the accuracy of other matters that may be contained in such submittals, including but not limited to such matters as dimensions, quantities and performance of equipment. Contractor shall furnish construction means, methods, techniques, sequences, procedures or safety precautions, the correctness of which as set forth in the contract documents or submittal shall be the sole responsibility of the Contractor.
- F. Only equipment, fixtures, material and components of those manufacturers indicated in this specification are acceptable. Products that have not been reviewed and accepted by the GUHSD Representative before the bidding period will not be accepted.

To be considered as an acceptable **substitution**, confirm that the alternate manufacturers' equipment or fixture is comparable with regard to such features as noise level, power requirements, metal gauges, vibration attenuation, finish, appearance, certification of recognized testing agencies and standard bureaus, allowable working pressures, physical size and arrangement. The Contractor shall also consider the effect of installation in the available space, factory-applied insulation, electrical devices, controls, access to internal parts, operating efficiencies, and all other features and capacities specified herein. The GUHSD Representative shall be the judge of the ability of any equipment, fixture or material to meet the requirements of this specification and the burden of proof shall be the responsibility of the Contractor.

- G. Format: Each type of equipment, fixture or material shall be submitted in a separate section of the submittal package and each such section shall have:

- H. A cover sheet identifying the equipment or fixture by the numbers or letter identical to those listed on the Drawings and/or Specifications, the manufacturer, the model number and size, and the technical data required for each piece of equipment or fixture. Materials shall be identified by system type.
- I. Dimensional drawings (including optional accessories appropriate to this project).
- J. Electrical data tables showing voltage, phase, horsepower (or kW), full load (or rated load) amperes and maximum fuse protection for each piece of equipment.
- K. Capacity data tables.
- L. Each submittal shall specifically reply to every item of equipment, fixture or material specified or scheduled. All information shall be listed on the submittal cover sheet and shall be marked in the submitted manufacturer's literature. All exceptions to the individual specifications shall be listed separately on the submittal cover sheet and shall be noted on submittal "cut sheet".
- M. Shop drawings are required for the plumbing systems. Submit one set of original drawings suitable for reproducing clear copies and provide six copies of drawings. The shop drawings will be reviewed. Contractors shall reproduce copies for their use. Shop drawings, equipment, fixture and material submittals shall be delivered at the same time.

1.05 INVESTIGATION OF CONDITIONS

- A. Where new underground trenching is required on sites or in any area where existing underground utilities exist, the contractor shall provide an independent professional utility locating service to locate exact vertical and horizontal locations of all existing utilities. Where existing utilities are found the contractor shall hand dig those areas to avoid disruption, the contractor shall be responsible for immediate repairs to existing underground utilities damage during construction. The contractor shall repair all existing asphalt, concrete and landscape surfaces damaged or removed during construction to match their original conditions. Where trenching extends through public streets or roadways, the contractor shall notify underground service alert in addition it the independent locating service before start of construction to determine location of existing utilities.
- B. {This project is a remodel of an existing site with existing buildings. There are existing conditions and utilities that must be accounted for and an examination of the building and site is mandatory.}
- ~~C. [This project is a remodel of existing buildings. There are existing conditions that must be accounted for and an examination of the building and site is mandatory.]~~
- ~~D. [This project is on an existing site with existing utilities and an examination of the site is mandatory.]~~
- E-C. Examine the existing conditions bearing on labor, transportation, handling and storage of materials, etc. Visit the site to understand the nature and scope of all work to be performed. The submission of a bid will be taken as evidence that such an examination has been made and all conditions have been considered.

1.06 EXISTING INSTALLATION AND CONFLICTS

- A. Existing active services, water, sewer, electric, other piping systems, when encountered, shall be protected against damage due to construction work. Do not disturb operation of active services that are to remain.
- B. If existing active services are encountered which require relocation, make request to the GUHSD Representative for determination of procedures. Where existing services are to be abandoned, they shall properly terminate in conformance with requirements of the GUHSD Representative.
- C. If work makes temporary shut-downs of services unavoidable, consult with GUHSD Representative as to dates, procedures and estimated duration of shut-down period in advance of the date work is to be performed.
- D. Work shall be performed to assure that the existing operating services will be shutdown only during the time allowed and required to construct necessary connections. If a system cannot be shutdown, temporary bypass jumpers shall be installed until connections are complete.
- E. Be responsible for all costs incurred by the above shut-downs, including bypass or jumper installations for work performed under Division 22.
- F. If existing active utility services are encountered which require relocation, make request to GUHSD Representative or other proper authorities for determination of procedures. Where existing services are to be abandoned, they shall properly terminated and capped.

1.07 ORGANIZATIONS

- A. Below is a list of organizations that may be identified throughout the specifications by the letters in parenthesis only.
 - 1. American Society of Mechanical Engineers (ASME)
 - 2. American Society for Testing and Materials (ASTM)
 - 3. American Water Works Association (AWWA)
 - 4. Factory Mutual Laboratories (FM)
 - 5. National Electrical Manufacturer's Association (NEMA)
 - 6. Underwriters' Laboratories, Inc. (UL)
 - 7. American National Standards Institute (ANSI)

1.08 DEFINITIONS

- A. Furnish: To purchase and supply equipment, fixtures, materials or components and deliver to the jobsite.
- B. Install: To place, fix in position, secure, anchor, etc., including necessary appurtenances and labor so the equipment, fixtures or material of the installation will function as specified and intended.
- C. Provide: To furnish and install.
- D. Piping: Includes, in addition to pipe, all fittings, flanges, valves, hangers, and other accessories related to such piping.

- E. Concealed: Means hidden from sight in chases, furred spaces, shafts, hung ceilings, or embedded in construction.
- F. Exposed: Means not installed underground or "concealed" as defined above. Tunnels, trenches, attic spaces and crawl spaces are considered exposed.
- G. Accepted/Acceptable: Items, that in the opinion of the GUHSD Representative, are acceptable alternates for the item specified.

1.09 CODE, PERMITS AND FEES

- A. The drawings and specifications take precedence when they are more stringent than codes, ordinances, standards and statutes. Codes, ordinances, standards and statutes take precedence where they are more stringent than the drawings and specifications.
- B. Secure and pay for permits, tests, Certifications of Inspection, and all other costs incidental to the work.

1.10 GENERAL COORDINATION OF WORK AND WORKING PROCEDURES

- A. All equipment, fixtures and materials shall be covered or otherwise protected from the weather, theft, etc., both when stored on the site and after installation, until final acceptance by the GUHSD Representative. All open ends of installed piping for partially completed systems shall temporarily be plugged and capped.
- B. All materials of construction shall be new and shall bear the manufacturer's labels and trademarks.
- C. The specifications indicate general requirements for the installation of all equipment, fixtures and materials however, follow the specific instructions and directions furnished by the equipment or fixture manufacturer.
- D. All equipment or fixtures shall be installed with full consideration of future maintenance. Equipment or fixtures that are installed such that it cannot be readily serviced shall be removed and installed correctly as directed to facilitate servicing.
- E. Unions, valves, and other components that may require lubrication or maintenance shall be located to provide sufficient accessibility. When necessary, provide access doors as hereinafter specified at all locations where these items are concealed within walls, chases, or above ceilings which do not have an inherent accessibility feature.
- F. Prior to testing clean and flush all piping systems.
- G. Surfaces to be painted shall be wiped, scraped, or wire-brushed as necessary to a clean, smooth painting surface, free from oil, rust and dirt. All material and equipment that is furnished with a factory prime coat of paint, which is damaged in transit, during storage, or from exposure to weather, shall be prime painted.
- H. Contractor shall be responsible for costs related to damage caused by leaks in piping systems, or any other malfunction of the equipment, fixtures, materials, systems, or work, including repairs, replacements, etc.

- I. Contractor shall provide information to other Contractors relative to all required pipe penetrations in walls, floors, roofs etc. The Contractor shall provide information to other Contractors relative to heights of piping systems. Structural work shall not be altered in any way.
- J. All necessary cutting and patching of roofs, walls, floors, ceilings, etc., as required for the proper installation of the work under this section, shall be performed, and in a neat and workmanlike manner. No joists, beams, girders, columns, or other structural member shall be cut.
- K. Contractor to provide all scaffolding, rigging, hoisting, and services necessary for erection and delivery into the premises for all equipment, fixtures and materials, and remove same from premises when no longer required.
- L. Carefully lay out work on the premises and make proper provision for the other work. The exact location of each item shall be determined by reference to the drawings, by measurements at the building, and in cooperation with other contractors. Be responsible for accurately locating all openings for pipes, etc., and all access doors required.
- M. Schedule and coordinate work so as to execute expeditiously the contract and to avoid unnecessary delays.
- N. Examine fully the specifications and drawings for other trades, to become familiar with all conditions affecting work, and consult and cooperate with other trades for determining space requirements and adequate clearances with respect to other equipment in the building.
- O. If the work is installed without coordinating with other trades, and the installation interferes with their installation, the contractor shall make any changes necessary in this work to correct conditions without extra charge.

1.11 ELECTRICAL

- A. Coordinate the voltage and phase characteristics of each electrical item such as electrical water heaters, fixture electrical sensors and motors with the electrical shop drawings.
- B. NEMA Standards shall be taken as minimum requirements for design and performance.
- C. Motors shall be suitable for load, duty, voltage, frequency, hazard and for service and location intended. Motors shall be high efficiency type. Motors shall have name plate giving manufacturers name, shop number, HP, RPM and current characteristics.

1.12 MOTOR STARTERS

- A. Provide motor starters for all plumbing equipment. Provide correct size and voltage characteristics per electrical requirements. Motor starters shall be provided by Division 22 and coordinated with electrical drawings.

1.13 EQUIPMENT SUPPORTING PROVISIONS

- A. Contractor shall confirm locations with GUHSD Representative before installation of hangers, platforms, equipment frames, etc. Contractor shall coordinate all related work with other trades.

- B. Equipment schedules on the drawings indicate a particular manufacturer for all equipment and the architectural and structural drawings indicate supports and other design considerations which were based on the use of this equipment.
- C. Contractor shall confirm all support dimensions and locations based on the actual equipment to be installed and shall coordinate all related work with other Contractors.
- D. Where supports, foundations, stands, suspended platforms for equipment are indicated on drawings or specified in specifications design and construct supporting structures of strength to safely withstand stresses to which they may be subject and to distribute properly the load and impact over building areas. Conform to applicable technical societies' standards, also to codes and regulations of agencies having jurisdiction. Contractor shall provide sufficient supports as required. These supports are for foundations, supporting stands, platforms and they shall be connected to the building structural members. All equipment shall be bolted to supports, foundations, stands and platforms. Design of the supports, foundations, supporting stands and platforms must be approved by a California State Licensed Structural Engineer.

1.14 PIPE SLEEVES

- A. Sleeves shall be schedule 40 galvanized steel pipe.
- B. Pipe motion due to expansion and contraction will occur, make sleeves of sufficient diameter to permit free movement of pipe. Where pipes are insulated, make sleeves of sufficient diameter to pass pipe insulation. Check floor and wall construction and finishes to determine proper length of sleeves for various locations. Terminate sleeves flush with walls, partitions and ceiling. Extend sleeves 1/4" above finish floor, except in equipment rooms and other areas where water may accumulate on floor, extend to 1-1/2".
- C. Set sleeves in ample time to permit pouring of concrete or to allow progression of other work as scheduled. Fasten sleeves securely so that they will not become displaced when concrete is poured or when other construction around them. For sleeves in fire walls, pack space between sleeve and pipe with approved non-combustible material and as otherwise required by local code; for floors where water is to be kept out, fill with graphite packing and caulking compound.
- D. Sleeves in underground walls shall be 1-1/2" larger than outside diameter of pipe. The space between sleeve and pipe shall be sealed with 1" long wool and 1/2" water tight flex caulking on both sides of the wall. The seal shall be guaranteed watertight.

1.15 ESCUTCHEONS

- A. Provide 20 gauge escutcheons at all pipe penetrations in walls, ceilings and floors. Escutcheons shall be one piece or hinged two piece type with positive latch or setscrew, and shall be polished chrome plated in finished rooms, and polished brass in other areas. Escutcheons shall have tempered springs or other means to insure positive attachment to pipe. The escutcheon opening shall be of sufficient diameter to fit around the insulation of insulated pipes, and the outside diameter of the escutcheon shall be of sufficient size to conceal the pipe sleeves.

1.16 EXPANSION AND FLEXIBILITY

- A. Install all work with regard for expansion and contraction to prevent damage to the piping, equipment, fixtures and the building and its contents. Provide piping offsets, expansion loops, approved type expansion joints, anchors or other means to control pipe movement and to minimize pipe forces.

1.17 ACCESS PANELS/DOORS

- A. Provide access panels/doors. Refer to other Division 22 Sections for further reference. Provide access panels/doors with have same fire rating as ceiling, wall in which they are installed, and shall be of sufficient size to provide the required accessibility.
- B. Provide access panels/doors where necessary to provide access to concealed water hammer arrestors, trap primers, cleanouts, shut off valves, control valves etc.
- C. Access doors:
 - 1. Material and Manufacturer: Stainless Steel Series is 16 gage #304 stainless steel door and frame. Provide cylinder key lock. Equal to MIFAB UA-SS. All MIFAB cylinder locks are keyed alike.
 - 2. Sizes shall be 14" X 14" at easily accessible valves, water hammer arrestors, trap primers, cleanouts etc; 18" X 18" where partial body access is required; 24" X 24" where entire body access is necessary.
 - 3. Confer with other contractors with respect to access panel locations and shall wherever practicable group mechanical and electrical equipment in such a way as to be accessible from a single panel and reduce number of doors required.

1.18 TRENCHING, EXCAVATING AND BACKFILLING

- A. Perform all trenching, excavation and backfilling necessary for the installation of underground piping [sewers, natural gas, water piping, receivers, interceptors, tanks, and other piping] as required.
- B. Obtain the services of an "Underground Locator Service". This Underground Locator Service shall identify all utilities or structures that may be in the path of the underground piping.
- C. Concrete and asphalt shall be removed by first providing saw cut lines. These new saw cut lines shall be at existing joints. For concrete cut and removal, a whole section of concrete from joint line to joint line shall be cut and removed.
- D. Dig trenches to required grade and depth with only sufficient earth material removed to provide working space. Trenches dug below the required depth shall be refilled to proper depth with sand.
- E. Restore to original condition all paved surfaces, including concrete, asphalt, landscaping and any other work which was cut or disturbed through the performance of work under this contract. New concrete and asphalt shall match the existing thickness, density, quality, material characteristics and surface appearance.
- F. All testing and inspections shall be complete, and approvals obtained, before backfilling is performed.

- G. Backfill material around pipe shall consist of sand. Provide a minimum of 4 inches of sand all round piping systems. The remainder of the backfill materials shall be free of rocks, debris, and other foreign materials and shall consist of earthy sand.
- H. Provide tracer wire around site non metallic water piping systems. Provide tracer wire around site non metallic natural gas piping systems. Tracer wire shall be 14 gauge copper wire with plastic covering. Tracer wire shall extend 6 inches above grade at the ends of the piping systems. Provide warning tape a minimum of 18" above pipe.
- I. Water puddle and tamp backfill material in layers of approximately 6" up to finish grade, and as otherwise required so that no settling will occur.
- J. All excess excavated materials shall be disposed of.

1.19 CORROSION PROTECTION

- A. All metallic piping underground shall wrap with 2 layers of 10-mil plastic tape.
- B. No pressurized water lines or natural gas lines will be permitted under building the concrete slab.
- C. All natural gas and water valves, water pressure regulators and other devices shall installed in pre-cast concrete yard boxes with galvanized steel lids. All natural gas and water valves, water pressure regulators and other devices will not be installed in any soil.
- D. Any piping passing through concrete floors, walls or roofs shall be sleeved and wrapped 3 times with plastic foam wrap. Provide epoxy joint sealer, non-shrink, waterproof caulking around all piping risers coming up through concrete floors & sidewalks. If the floors, walls or roofs are existing then core these areas. Provide foam sealant and epoxy joint sealer (non-shrink) waterproof caulking around the space between the pipe and the floors, walls or roofs.
- E. Provide one piece natural gas transition riser from PE pipe to steel pipe. The schedule 80 steel section of the riser shall be epoxy coated. The transition riser shall meet NFPA-58 and ASTM D2513.

1.20 FIRE STOPPING

- A. Provide fire stopping at all rated floors, walls or roofs. Use UL listed materials and methods for sealing these areas.

1.21 IDENTIFICATION OF EQUIPMENT

- A. Each item of equipment shall be permanently labeled with a plastic nameplate of sufficient size to clearly indicate the identification designation appearing on the construction drawings. Letters shall be a minimum of 2 inches high.

1.22 GENERAL TESTING REQUIREMENTS FOR EQUIPMENT AND FIXTURES

- A. The following requirements are supplementary to tests specified for individual equipment, fixtures or systems in other Division 22 sections:
 - 1. Furnish labor, materials, instruments, electric power, etc., and bear all costs in connection with these tests.

2. Give a minimum of 72 working hour notification to the GUHSD Representative when tests will be conducted. Coordinate test with other trades.
 3. After the work has been completed, subject all systems to acceptance tests under normal operating conditions for periods of 5 working days to show compliance with Contract requirements. Submit to the GUHSD Representative a written certificate that all tests have been performed in accordance with the specification requirements.
 4. All motors shall run at their required speed without showing undue vibration, objectionable noise, or sparking for a period of 5 working days.
 5. The drainage system shall be tested in accordance with the rules and regulations of the authoritative agencies.
 6. Submit to the GUHSD Representative a written certificate that all tests have been performed in accordance with the specification requirements.
- B. Adjustments, repairs, and re-tests:
1. Make adjustments, repairs and alterations, as required to meet specified test results.
 2. Correct defects disclosed by tests or inspections, and replace defective parts when directed.
 3. In replacing defective parts, use only new materials, and in the case of pipe, replace with same length as defective piece.
 4. Repeat tests after defects have been corrected and parts replaced, as directed and until pronounced satisfactory.
 5. Bear the cost of repairs, and restoration of the work by other Contractors that have been damaged by the tests.

1.23 RECORD DRAWINGS

- A. Maintain at the site, a set of record drawings, upon which shall be clearly indicated (by shading, coloring, or some other acceptable method) the day by day extent of the work installed. Indicate all changes to the original design at the end of each day.
- B. At the completion of the construction phase, furnish to the GUHSD Representative all necessary drawings showing work which was not installed as shown in the contract drawings. A minimum of one set of originals and three copied sets shall be furnished. Indicate all pertinent information, i.e., valve locations, pipe routing (dimensionally located), etc. All underground piping shall be located on the record drawings by two or more dimensions. All elevations (inverts) shall be shown with the point of elevation change clearly located. All valves shall be numbered and lettered to correspond with the numbers and letters on the site.

1.24 EMERGENCY REPAIRS

- A. The Owner reserves the right to make emergency repairs as required to keep systems in operation without relieving the Contractor of his responsibilities during the post/partial beneficial occupancy.

1.25 OPERATION BY OWNER

- A. The GUHSD may require operation of parts or all of the respective installations prior to final acceptance. The Owner shall pay for cost of utilities for such operation. Operation of the installation shall not be construed as acceptance of the work.

1.26 INSTRUCTION MANUAL

- A. Prior to completion of installation and final inspection of work, furnish to the GUHSD Representative a minimum of three copies of complete instruction manual, bound in booklet form and indexed for each respective trade.
- B. Manual shall contain the following items:
 - 1. List of all equipment with manufacturer's name, model number and local representative, service facilities, and normal channel of supply for each item.
 - 2. Manufacturer's literature describing each item of equipment or fixtures with detailed parts list.
 - 3. Detailed step-by-step instructions for starting and shutdown of each system.
 - 4. Detailed maintenance instructions for each system and piece of equipment or fixtures.
 - 5. Copy of each automatic control diagram with respective sequence of operations.
 - 6. Individual equipment or fixtures guarantees.
 - 7. Certificates of inspections.
 - 8. Copies of as-built construction and related shop-drawings.
 - 9. All written material contained in manual shall be typewritten.

1.27 INSTRUCTION OF OWNER'S PERSONNEL

- A. Prior to acceptance of work and during time designated by the GUHSD Representative provide necessary qualified personnel to operate each system and fully instruct GUHSD Facility Representatives in complete operations, adjustment, and maintenance of each respective installation.

1.28 GUARANTEES AND WARRANTIES

- A. All work shall be guaranteed to be free from defects in material and workmanship for a period of one year from the date of final acceptance of the work, or a longer period if stipulated under specific headings. Replace at no additional cost any material, fixtures or equipment developing defects and also pay for any damage caused by such defects, or the correction of defects.
- B. Use warrantee terms for specific items of equipment, relative to the work guarantee requirements of this specification.

33 DIV. MASTER SPECIFICATIONS
GROSSMONT UNION HIGH SCHOOL DISTRICT
(revised) MAY 26, 2017 ~~MARCH 20, 2014~~

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3- EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 22 07 00

PLUMBING INSULATION

PART 1 - GENERAL

1.01 SUMMARY

- A. Provide labor, equipment and materials, and perform all operations necessary for the installation of insulation as indicated. This section includes thermal insulation for piping and equipment.
- B. Provide complete Insulation Submittals and Shop drawings. Refer to Plumbing General Provision Section 22 01 00 Paragraph 1.4 Submittals - Shop Drawings/Product Data/Material Certifications.

1.02 RELATED SECTIONS

- A. Section 22 01 00 Plumbing General Provision
- B. Section 22 20 00 Plumbing Systems, Fixtures and Equipment

1.03 FIRE HAZARD CLASSIFICATION

- A. Insulation shall have a composite (insulation, jacket or facing, and adhesive to secure jacket or facing) fire hazard rating as tested by ASTM E-84, NFPA 255, or UL 723 not to exceed 25 flame spread and 50 smoke developed. Materials labeled accordingly.
- B. Insulation shall conform to current versions of the California Plumbing and Mechanical Code. |

1.04 QUALITY ASSURANCE

- A. Furnish insulation systems to the project site bearing the manufacturer's label.
- B. Appearance shall be of equal importance with its mechanical correctness and efficiency.

1.05 PROTECTION

- A. Protect insulation against dirt, water, chemical, or mechanical damage before, during and after installation. Any such insulation or covering damaged prior to final acceptance of the work shall be satisfactorily repaired or replaced.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

1.07 SUBMITTALS

- A. Comply with specification Section 22 01 00 General Provision for Plumbing.
- B. Required Submittals
 - 1. Piping insulation, jackets and accessories.
 - 2. Equipment insulation and covering.

3. For each product being submitted, provide product description, list of materials, thickness, location of use and manufacturer's installation instructions.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Acceptable manufacturers for insulation are Johns Manville Corporation, Owens-Corning and Knauf Insulation.
- B. Acceptable manufacturers in addition to insulation manufacturers for adhesives, sealants and coatings are Foster Construction Products Inc.
- C. Duct tape is not an approved sealer tape and shall not be used on this project.

2.02 PIPING SYSTEM INSULATION

- A. Insulation Type
- B. Glass Fiber: Johns Manville Micro-Lok meeting ASTM C547 or equal; rigid molded, noncombustible, Class 1 not to exceed 25 flame spread and 50 smoke developed.
 1. 'K' ('KSI') Value: 0.23 at 75 degrees F (0.033 at 24 degrees C).
 2. Maximum Service Temperature: 850 degrees F (454 degrees C).
 3. Vapor Retarder Jacket: AP-T PLUS White kraft paper reinforced with glass fiber yarn and bonded to aluminum foil, secure with self sealing longitudinal laps and butt strips or AP Jacket with outward clinch expanding staples or vapor barrier mastic as needed. All insulation and jacket material shall be plenum rated.
 4. Provide 18 gauge galvanized metal insulation shields at pipe hangers. Insulation shields shall provide an expanded surface area to carrier the weight of the piping without distorting or damage to insulation.
- C. Elastomeric Foam: K-Flex Insul-Tube or equal; meeting ASTM C534, flexible, cellular elastomeric, molded or sheet, Grade 1 not to exceed 25 flame spread and 50 smoke developed:
 1. 'K' ('KSI') Value: 0.28 at 75 degrees F (0.04 at 24 degrees C).
 2. Maximum Service Temperature of 220 degrees F (104 degrees C).
 3. Maximum Flame Spread: 25.
 4. Maximum Smoke Developed: 50.
 5. Connection: Waterproof vapor retarder adhesive, as needed; K-Flex 373 Contact Adhesive.
 6. UV-Protection: Outdoor protective coating; K-Flex 374 Protective Coating.
 7. Provide 18 gauge galvanized metal insulation shields at pipe hangers. Insulation shields shall provide an expanded surface area to carrier the weight of the piping without distorting or damage to insulation.

D. Field Applied Jackets

1. Aluminum Jacket: 0.016 inch (0.045 mm) thick sheet, (smooth / embossed) finish, with longitudinal slip joints and 2 inch (50 mm) laps, die shaped fitting covers with factory attached protective liner.

2.03 FIRE STOPPING INSULATION

- A. Fire stop insulation shall be ceramic fiber blanket equal to Cerablanket by Morgan Thermal Ceramics or USG Thermafiber 6 lb. density, Class 1 not to exceed 25 flame spread and 50 smoke developed.

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. Verify that piping has been pressure tested for leakage before applying insulation materials.
- B. Verify that all surfaces are clean, dry and free of foreign material. Apply insulation on clean, dry surfaces free of any foreign matter and only after tests and approvals required by the specifications have been completed.

3.02 GENERAL INSTALLATION

- A. Install materials in accordance with manufacturer's recommendations, building codes and industry standards.
- B. Continue insulation vapor barrier through penetrations except where prohibited by code.
- C. Insulation shall be installed by workmen regularly engaged in this kind of work in accordance with the manufacturer's recommendations.
- D. All exposed raw edges shall be finished with finishing cement.
- E. If staples are used, all must be coated with adhesive to maintain vapor barrier integrity. Thickness per ASHRAE Standards Table.

3.03 PIPING SYSTEM INSULATION INSTALLATION AND SCHEDULE

- A. Pipe insulation shall be continuous through walls and floor openings except where walls and floors are required to be fire stopped or required to have a fire resistance rating. Where this occurs, the open space remaining between the sleeve and pipe shall be filled with fire stop insulation.
- B. Insulation on piping indicated must be applied with a continuous, unbroken vapor seal. Supports, anchors, etc., that are secured directly to cold surfaces must be adequately insulated and vapor sealed to prevent condensation.
- C. Insulated pipes shall be insulated continuously through hangers. Rigid insulation inserts and metal shields are to be provided at all pipe hangers and supports. Pipe insulation shall abut the rigid insulation insert. Apply a wet coat of vapor barrier lap cement on all butt joints and seal the joints with 3" wide vapor barrier tape or band.
- D. Butt all joints firmly together and smoothly, secure all jacket laps and joint strips with lap adhesive.

- E. Locate insulation and cover seams in least visible locations.
- F. Neatly finish insulation at all supports, protrusions, and interruptions.
- G. Provide insulated pipes conveying fluids below ambient temperature with vapor retardant jackets with self sealing laps. Insulate complete system.
- H. For insulated pipes conveying fluids above ambient temperature, secure jackets with self sealing lap or outward clinched, expanded staples. Bevel and seal ends of insulation at equipment, flanges, and unions.
- I. Provide shield between isolation inserts and hanger supports. Shields shall be minimum of 20 gauge galvanized metal. Fabricate of Johns Manville Thermo-12 or other heavy density insulating material suitable for temperature. Insulation inserts shall not be less than the following lengths;

	1 1/2" to 2 1/2" pipe size	10" long
3" to 6" pipe size	12" long	
8" to 10" pipe size	16" long	
12" and over	22" long	
- J. For pipe exposed in equipment rooms or unfinished spaces provide field applied aluminum jacket.
- K. For exterior piping applications, provide field applied protection jacket or coating. Insulated pipe, fittings, joints, and valves shall be covered with field applied [aluminum] jacket. Jacket seams shall located on bottom side of horizontal piping.
- L. For return air plenum areas provide non-combustible jacket.
- M. Fittings and valves shall be covered with pre-molded one-piece insulated covers.
- N. Piping Insulation Schedule
 - 1. Fiber Glass Insulation
 - a. Domestic Hot Water (supply and return piping):

pipe: up to 2"	1 inch thick
pipe: 2 1/2" to 4"	1 1/2 inch thick
 - b. Condensate piping system

pipe: up to 2"	3/4 inch thick
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- O. All fixtures that are accessible shall have an OFF-set grid drain permitting the trap to be installed flush with the wall. In addition provide PROWRAP insulation kit for exposed hot water pipe, tailpiece, and trap as manufactured by MCGUIRE, and secured per manufacturers recommendations. ADA fixtures only.

END OF SECTION

SECTION 22 11 13

WATER DISTRIBUTION

PART 1 – GENERAL

1.1 SECTION INCLUDES

- 1.1.1 Extent of potable water systems work is indicated on drawings and schedules, and by requirements of this section.
- 1.1.2 Refer to Section 312300 for excavation and backfill required for potable water systems; not work of this section.

1.2 QUALITY ASSURANCE

- 1.2.1 Manufacturer's Qualifications: Firms regularly engaged in manufacture of potable water systems, materials and products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- 1.2.2 Water Purveyor Compliance: Comply with requirements of local water agency, supplying water to project, obtain required permits and inspections.

1.2.3 Codes and Standards:

- 1.2.3.1 Regulatory Requirements: Comply with applicable portions of codes, standards, specifications and regulations of governmental agencies having jurisdiction. Some of the other agencies having jurisdiction are _____ Water District.
- 1.2.3.2 _____ Water District will inspect and approve all work within their jurisdiction.
- 1.2.3.3 Pay for all water district permits in conjunction with this work.
- 1.2.3.1 Comply with the applicable portions of the 2013 California Building Code (CCR Title 24, Part 2) Chapter 33.
- 1.2.3.2 Comply with the applicable portions of the 2013 California Fire Code (CCR Title 24, Part 9) Chapters 5 and 9.
- 1.2.3.3 Coordinate work of this Section with Permit provisions of the State of California Water Resources Control Board Order Number 2012-0006-DWQ.
- 1.2.3.4 The project Storm Water Pollution Prevention Plan.
- 1.2.3.5 2013 California Electrical Code (CCR Title 24, Part 3).
- 1.2.3.6 2013 California Plumbing Code (CCR Title 24, Part 5).
- 1.2.3.7 Cal-OSHA.
- 1.2.3.8 OSHA.
- 1.2.3.9 American National Standards Institute (ANSI) A21.10

- 1.2.3.10 American Society for Testing and Material (ASTM) F 477, Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- 1.2.3.11 American Water Works Association (AWWA) Publications regarding pipe and installation:
 - 1.2.3.11.1 AWWA C 104
 - 1.2.3.11.2 AWWA C 110.
 - 1.2.3.11.3 AWWA C 111.
 - 1.2.3.11.4 AWWA C 115.
 - 1.2.3.11.5 AWWA C 151.
 - 1.2.3.11.6 AWWA C 600.
 - 1.2.3.11.7 AWWA C 651.
 - 1.2.3.11.8 AWWA C 900.
 - 1.2.3.11.9 AWWA C 901.
 - 1.2.3.11.10 AWWA M 23

1.2.4 Uni-Bell Plastic Pipe Association (UNI) - B - 3 with AWWA C 900.

1.2.5 National Fire Protection Association 24 - Standards for the Installation for Private Fire Service Mains and Their Appurtenances 2013 Edition (NFPA 24)

1.3 SUBMITTALS

- 1.3.1 Product Data: Submit manufacturer's technical product data and installation instructions for potable water system materials and products.
- 1.3.2 Shop Drawings: Submit shop drawings for potable water systems, showing piping materials, size, locations, and elevations. Include details of underground structures, connections, thrust blocks, and anchors. Show interface and spatial relationship between piping and proximate structures.
- 1.3.3 Record Drawings: At project closeout, submit record drawings of installed potable water system piping and products, in accordance with requirements of Division 1.
- 1.3.4 Maintenance Data: Submit maintenance data and parts lists for potable water system materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual in accordance with requirements of Division 1.

PART 2 – PRODUCTS

2.1 IDENTIFICATION

- 2.2.1 Plastic Underground Warning Tapes: Polyethylene plastic tape, 6 inches wide by 4 mils thick, solid blue in color with continuously printed caption in black letters "CAUTION - WATER LINE BURIED BELOW."

- 2.1.2 Metallic-Lined Plastic Underground Warning Tapes: Polyethylene plastic tape with metallic core, 6 inches wide by 4 mils thick, solid blue in color with continuously printed caption in black letters "CAUTION - WATER LINE BURIED BELOW."
- 2.1.3 Nonmetallic Piping Label: Engraved plastic-laminate label, for installation on main electrical meter panel; not less than 1 inch by 3 inches, with captions "CAUTION - THIS STRUCTURE HAS A NONMETALLIC WATER SERVICE."

2.2 PIPES AND PIPE FITTINGS

- 2.2.1 General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes and types matching piping and equipment connections; provide fittings of materials, which match pipe materials used in potable water systems.
- 2.2.2 Piping: Provide pipes of one of the following materials, of weight/class indicated. Provide pipe fittings and accessories of same material and weight/class as pipes.
 - 2.2.2.1 Ductile-iron, AWWA C110; asbestos-cement couplings; rubber rings conforming to ASTM D 1869, and joints conforming to AWWA C111.
 - 2.2.2.2 Ductile-Iron Pipe: AWWA C151, with cement mortar lining complying with AWWA C104; Class 51 unless otherwise indicated.
 - 2.2.2.3 Polybutylene (PB) Pipe: AWWA C902 for sizes 1/2" through 3", and ASTM D 2662 for sizes 1/2" through 6"; SDR 15.
 - 2.2.2.4 Polyvinyl Chloride (PVC) Pipe: AWWA C900 for sizes 4" through 12"; Class 150.
 - 2.2.2.5 Polyvinyl Chloride (PVC) Pipe: ASTM D 1785, Schedule 40 for sizes 1/2" through 3".
 - 2.2.2.6 Polyethylene (PE) Pipe: AWWA C901 for sizes 1/2" through 3".

2.3 VALVES

- 2.3.1 Gate Valves: Provide as indicated, gate valves, AWWA C500, 175 psi working pressure. Provide threaded, flanged, hub, or other end configurations to suit size of valve and piping connection. Provide inside screw type for use with curb valve box, iron body, bronze-mounted, double disc, parallel seat, non-rising stem.
 - 2.3.1.1 Available Manufacturers: Subject to compliance with requirements, manufacturers offering gate valves which may be incorporated in the work include, but are not limited to, the following: Subject to compliance with requirements, provide gate valves of one of the following:
 - 2.3.1.1.1 Clow Corp; Valve Div.
 - 2.3.1.1.2 Dresser Mfg.; Div. of Dresser Industries.
 - 2.3.1.1.3 Cla-Val Co.
 - 2.3.1.1.4 Kennedy Valve; Div. of ITT Grinnell Valve Co. Inc.
 - 2.3.1.1.5 American AVK Co.

2.3.1.1.6 Waterous Co.

2.3.2 Butterfly Valves: Provide as indicated, butterfly valves, AWWA C504, 150 psi working pressure. Provide iron body, bronze disc, stainless steel stem, and metal-reinforced EPDM seat.

2.3.2.1 Available Manufacturers: Subject to compliance with requirements, manufacturers offering butterfly valves which may be incorporated in the work include, but are not limited to, the following: Subject to compliance with requirements, provide butterfly valves of one of the following:

2.3.2.1.1 Demco; Div. of Copper Industries, Inc.

2.3.2.1.2 ITT Grinnell Valve Co. Inc.

2.3.2.1.3 Keystone Valve; Div. of Keystone International Inc.

2.3.2.1.4 Cla-Val Co.

2.3.2.1.5 American AVK Co.

2.3.3 Check Valves: Provide as indicated, swing check valves, AWWA C508, 150 psi working pressure. Provide iron body, cast-iron disc, bolted cap.

2.3.3.1 Available Manufacturers: Subject to compliance with requirements, manufacturers offering check valves which may be incorporated in the work include, but are not limited to, the following: Subject to compliance with requirements, provide check valves of one of the following:

2.3.3.1.1 Clow Corp.; Valve Div.

2.3.3.1.2 Dresser Mfg.; Div. of Dresser Industries.

2.3.3.1.3 Fairbanks Co.

2.3.3.1.4 Kennedy Valve; Div. of ITT Grinnell Valve Co. Inc.

2.3.3.1.5 Stockham Valves and Fittings Inc.

2.3.3.1.6 Waterous Co.

2.3.3.1.7 American AVK Co.

2.4 FIRE HYDRANTS

2.4.1 Fire Hydrants: Wet barrel type complying with AWWA C503-88, UL listed, and local Fire Marshal approved.

2.4.2 Provide frangible section near the ground line designed to break on impact.

2.4.3 Provide one 2-1/2 inch and two 4-inch outlets. Provide cap with chain on each outlet.

2.4.4 Provide flanged, threaded, hub or sleeve type mechanical joint inlet connection designed to suit pipe or tapping sleeves connections.

2.4.5 Acceptable manufacturers or equal:

2.4.5.1 Clow Corp.

2.4.5.2 James Jones

2.4.5.3 Long Beach Iron Works

2.5 WATER METERS

2.5.1 Water Meters: Meters to be provided and installed by the local water agency.

2.5.2 Pipe, fittings, accessories, boxes, and materials complying with local water agency standards.

2.6 ACCESSORIES

2.6.1 Anchorages: Provide anchorages for tees, wyes, crosses, plugs, caps, bends, valves, and hydrants. After installation, apply full coat of asphalt or other acceptable corrosion-retarding material to surfaces of ferrous anchorages.

2.6.1.1 Clamps, Straps, and Washers: Steel, ASTM A 506.

2.6.1.2 Rods: Steel, ASTM A 575.

2.6.1.3 Rod Couplings: Malleable-iron, ASTM A 197.

2.6.1.4 Bolts: Steel, ASTM A 307.

2.6.1.5 Cast-Iron Washers: Gray-iron, ASTM A 126.

2.6.1.6 Thrust Blocks: Concrete, 2,500 psi. Size as shown on Construction Documents.

2.6.1.7 Yard Hydrants: Provide non-freeze yard hydrants, 3/4" inlet, 3/4" hose outlet, bronze casing, cast-iron or cast-aluminum casing guard, key-operated, and tapped drain port in valve housing.

2.6.1.7.1 Available Manufacturers: Subject to compliance with requirements, manufacturers offering yard hydrants which may be incorporated in the work include, but are not limited to, the following:

2.6.1.7.2 Manufacturers: Subject to compliance with requirements, provide yard hydrants of one of the following:

2.6.1.7.2.1 Josam Mfg. Co.

2.6.1.7.2.2 Smith (Jay R.) Mfg. Co.

2.6.1.7.2.3 Tyler Pipe.

2.6.1.7.2.4 Zurn Industries, Inc.; Hydromechanics Div.

PART 3 – EXECUTION

3.1 INSPECTION

3.1.1 General: Examine areas and conditions under which potable water system's materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.1.2 Surveyor Qualifications

3.1.2.1 Surveyor shall currently be licensed in the State of California as a Professional Land Surveyor.

3.1.2.2 Surveyor shall employ proper field procedures, instrumentation and adequate survey personnel in order to achieve accuracies as required by each section.

3.1.2.3 Cut sheets, if required, shall be provide to the Inspector of Record at the start of the following business day after completion of the work.

3.1.3 Domestic Water and Fire:

3.1.3.1 Stakes shall be located with positional accuracies of a minimum of 0.1 feet horizontally and 0.05 feet vertically.

3.1.3.2 One set of construction stakes with lath shall be set. Lath shall indicate offset, cut/fill, and reference point, i.e. "TC", "FL".

3.1.3.3 Stakes shall be set at maximum intervals of 50 feet, grade breaks, angle points, valves, meters, backflow devices, fire hydrants, fire department connections, post indicator valves, and building point of connections. All construction stakes shall be offset to the side of the utility at a distance from centerline designated by contractor and agreed to by surveyor prior to commencement of staking.

3.1.3.4 Surveyor shall provide to the Inspector of Record cut sheets for all staking. The contractor shall not commence work until Inspector of Record has provided copies of said cut sheets.

3.1.3.5 All stakes shall be preserved in place until such time that the Inspector of Record has approved utility installation for backfilling.

3.1.3.6 All pressure water lines shall be verified by the Inspector of Record for minimum depth of cover as designated by the plans and specifications.

3.1.3.7 Should a dispute arise over the position of the utility in question and the stakes provided for said installation are removed, destroyed, or disturbed, the contractor assumes full responsibility for all cost associated with the resolution of the dispute.

3.1.4 Beginning of installation means acceptance of existing conditions.

3.1.5 The Contractor shall notify Underground Service Alert at least two (2) days prior to starting work and shall coordinate all work with utility company representatives. The existence and locations of existing underground facilities indicated on the plans were obtained from a search of available records. The contractor shall be responsible for the protection of all existing utilities indicated on the plans, and any other which is not of record or indicated on the plans.

3.1.6 Prior to commencing the work, the contractor shall POTHOLE THE EXISTING UTILITIES at points of connections and or crossings of the proposed utilities.

3.2 INSTALLATION OF IDENTIFICATION

3.2.1 General: During back-filling/top-soiling of potable water systems, install continuous metallic lined underground warning tape, located directly over buried line at 6" to 8" below finished grade. Tape shall be polyethylene with metallic core, 6 inches wide by 4 mils

thick, solid blue color with continuously printed caption in black letters "CAUTION –
WATER LINE BURIED BELOW."

3.3 INSTALLATION OF PIPE AND PIPE FITTINGS

- 3.3.1 Copper Tube: Install in accordance with CDA "Copper Tube Handbook".
- 3.3.2 Ductile-Iron Pipe: Install in accordance with AWWA C600 "Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances".
- 3.3.3 Polyvinyl Chloride Pipe: Install in accordance with manufacturer's installation instructions.
- 3.3.4 Depth of Cover: Provide minimum cover over 4" diameter and smaller piping of 24" below finished grade and 36" minimum for piping 6" and larger diameter.
- 3.3.5 Water Main Connection: Arrange for tap in water main of size and in location as indicated, by City of Fontana Water Company Forces.
- 3.3.6 Water Service Termination: Terminate potable water piping 5'-0" from building foundation in location and invert as indicated. Provide temporary pipe plug for piping extension into building, by work of Division 15.

3.4 INSTALLATION OF VALVES

- 3.4.1 General: Install valves as indicated with stems pointing up.
- 3.4.2 Provide valve box over underground valves with valve covers set to finished grade and clearly marked to indicate "WATER".

3.5 INSTALLATION OF FIRE HYDRANTS

- 3.5.1 Comply with AWWA M17. Install with gate valve and provision for drainage as indicated.
- 3.5.2 Set hydrants plumb and locate 4" outlet perpendicular to fire lane.
- 3.5.3 Set hydrants to grade with nozzles at least 20 inches above ground.
- 3.5.4 Install with the face of the bottom flange of the barrel 4 to 6 inches above the adjacent ground or paving.
- 3.5.5 Locate control valve 24 inches away from hydrant.
- 3.5.6 Provide drainage pit 36 inches square by 24 inches deep filled with 2 inch washed gravel. Encase elbow of hydrant in gravel to 6 inches above drain opening. Do not connect drain opening to sewer.
- 3.5.7 Paint hydrants in accordance with the Fire Marshal having jurisdiction.
- 3.5.8 Fire hydrants shall be as approved by the Fire Marshal having jurisdiction.

3.6 INSTALLATION - BACKFLOW PREVENTORS

- 3.6.1 Install backflow preventer of type, size and capacity indicated for potable and irrigation point of connections. Include valves and test cocks.
- 3.6.2 Install according to local water agency.
- 3.6.3 Support backflow preventers, valves, and piping on 2,500-psi; concrete piers as indicated.

- 3.6.4 Double detector check for fire service point of connection shall be furnished and installed by local water agency.

3.7 TESTING OF FIRE SERVICE MAINS AND APPURTENANCES

- 3.7.1 Testing and acceptance of fire service mains and their appurtenances shall be in accordance with NFPA 24 2007 Edition.

- 3.7.2 Approval of Underground Piping: The installing contractor shall be responsible for the following:

3.7.2.1 Notifying the authority having jurisdiction and the owner's representative of the time and date testing is to be performed.

3.7.2.2 Performing all required acceptance tests.

3.7.2.3 Completing and signing the contractor's material and test certificate shown in Figure 10.10.1 of NFPA 24.

3.7.3 Acceptance Requirements

3.7.3.1 Flushing of Piping

3.7.3.1.1 Underground piping, from the water supply to the system riser, and lead-in connections to the system riser shall be completely flushed before the connection is made to downstream fire protection system piping.

3.7.3.1.2 The flushing operation shall be continued for a sufficient time to ensure thorough cleaning.

3.7.3.1.3 The minimum rate of flow shall not be less than one of the following:

3.7.3.1.3.1 Hydraulically calculated water demand flow rate of the system, including any hose requirements.

3.7.3.1.3.2 Flow necessary to provide a velocity of 10 ft/sec in accordance with Table 3.7.3.1.3.

3.7.3.1.3.3 Maximum flow rate available to the system under fire conditions.

Table 3.7.3.1.3 Flow Required to Produce a Velocity of 10 ft/sec in Pipes

Pipe Size	Flow Rate
(in)	(gpm)
4	390
6	880
8	1,560
10	2,440

12

3,520

3.7.3.2 Hydrostatic Test

3.7.3.2.1 All piping and attached appurtenances subjected to system working pressure shall be hydrostatically tested at 200 psi or 50 psi in excess of the system working pressure, whichever is greater, and shall maintain that pressure at +/-5 psi for 2 hours.

3.7.3.2.2 Pressure loss shall be determined by a drop in gauge pressure or visual leakage.

3.7.3.2.3 The test pressure shall be read from one of the following, located at the lowest elevation of the system or the portion of the system being tested:

3.7.3.2.3.1 A gauge located at one of the hydrant outlets

3.7.3.2.3.2 A gauge located at the lowest point where no hydrants are provided

3.7.3.2.4 Hydrostatic Testing Allowance: Where additional water is added to the system to maintain the test pressures required by 3.7.3.2.1, the amount of water shall be measured and shall not exceed the limits of Table 3.7.3.2.4 which is based on the following equation:

$$L = \frac{SD(P)^{1/2}}{148,000} \quad (3.7.3.2.4)$$

Where:

L = testing allowance (makeup water), in gallons per hour

S = length of pipe tested, in feet

D = nominal diameter of the pipe, in inches

P = average test pressure during the hydrostatic test, in pounds per square inch (gauge)

Table 3.7.3.2.4 Hydrostatic Testing Allowance at 200 psi per 100 Feet of Pipe

Nominal Pipe Diameter (in)	Testing Allowance in Gallons per Hour (gph) per 100 Feet of Pipe
2	0.019
4	0.038
6	0.057
8	0.076

10	0.096
12	0.115
14	0.134
16	0.153
18	0.172
20	0.191
24	0.229

Notes:

- (1) For other length, diameters, and pressures, utilize Equation 3.7.3.2.4 to determine the appropriate testing allowance.
- (2) For test sections that contain various sizes and sections of pipe the testing allowance is the sum of the testing allowances for each size and section.

3.7.3.3 Other Means of Hydrostatic Tests: Where required by the authority having jurisdiction, hydrostatic tests shall be permitted to be completed in accordance with the requirements of AWWA C600, AWWA C602, AWWA C603, and AWWA C900.

3.7.3.4 Operating Test

3.7.3.4.1 Each hydrant shall be fully opened and closed under system water pressure.

3.7.3.4.2 Dry barrel hydrants shall be checked for proper drainage.

3.7.3.4.3 All control valves shall be fully closed and opened under system water pressure to ensure proper operation.

3.7.3.4.4 Where fire pumps are available, the operating tests required by 3.7.3.4 shall be completed with the pumps running.

3.7.3.5 Backflow Prevention Assemblies

3.7.3.5.1 The backflow prevention assembly shall be forward flow tested to ensure proper operation.

3.7.3.5.2 The minimum flow rate required by 3.7.3.5.1 shall be the system demand, including hose stream demand where applicable.

3.7.3.6 The trench shall be backfilled between joints before testing to prevent movement of pipe.

3.7.3.7 Where required for safety measures presented by the hazards of open trenches, the pipe and joints shall be permitted to be backfilled, providing the installing contractor takes the responsibility for locating and correcting leakage.

3.7.3.8 Provision shall be made for the proper disposal of water used for flushing or testing.

3.8 TESTING OF WATER MAINS

- 3.8.1 Piping Tests: Conduct piping tests before joints are covered, and after thrust blocks have sufficiently hardened. Fill pipeline 24 hours prior to testing, and apply test pressure to stabilize system. Use only potable water.
- 3.8.2 Hydrostatic Tests: Test at not less than 1-1/2 times working pressure for 2-hrs.
- 3.8.3 Test fails if leakage exceeds 2-qts per hour per 100 gaskets or joints, irrespective of pipe diameter.
- 3.8.4 Increase pressure in 50-psi increments and inspect each joint between increments. Hold at test pressure for one hour, decrease to 0 psi. Slowly increase again to test pressure and hold for one more hour.

3.9 ADJUSTING AND CLEANING

- 3.9.1 Disinfection of Potable Water System: Flush pipe system with clean potable water until no dirty water appears at point of outlet. Fill system with water-chlorine solution containing at least 50 ppm of chlorine. Valve off system and let stand for 24-hrs minimum. Flush with clean potable water until no chlorine remains in water coming from system.
- 3.9.2 Repeat procedure if contamination is present in bacteriological examination.
- 3.9.3 Disinfection of Water Mains: Flush and disinfect in accordance with AWWA C601 "Standard for Disinfecting Water Mains".

END OF SECTION

SECTION 22 13 13

SANITARY SEWAGE SYSTEMS

PART 1 – GENERAL

1.1 SECTION INCLUDES

- 1.1.1 Site sanitary drainage piping, fittings, and accessories.
- 1.1.2 Connection of building sanitary drainage system to site sanitary sewers.
- 1.1.3 Connection of site sanitary drainage system to municipal sewers.
- 1.1.4 Manhole access and cleanout access.
- 1.1.5 Extent of sanitary sewage systems work is indicated on drawings and schedules, and by requirements of this section.
- 1.1.6 Refer to Section 312300 for excavation and backfill required for sanitary sewage systems; not work of this section.

1.2 QUALITY ASSURANCE

- 1.2.1 Manufacturer's Qualifications: Firms regularly engaged in manufacture of sanitary sewage system's products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- 1.2.2 Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with sanitary sewage work similar to that required for project.
- 1.2.3 Codes and Standards:
 - 1.2.3.1 Comply with the applicable portions of the 2016 California Building Code (CCR Title 24, Part 2) Chapter 33.
 - 1.2.3.2 Coordinate work of this Section with Permit provisions of the State of California Water Resources Control Board Order Number 2012-0006-DWQ.
 - 1.2.3.3 The project Storm Water Pollution Prevention Plan.
 - 1.2.3.4 2013 California Plumbing Code (CCR Title 24, Part 5).
 - 1.2.3.5 Cal-OSHA.
 - 1.2.3.6 OSHA.
 - 1.2.3.7 ANSI A21.10
 - 1.2.3.8 AWWA Publications regarding pipe and installation;
 - 1.2.3.8.1 AWWA C 110.
 - 1.2.3.8.2 AWWA C 111.
 - 1.2.3.8.3 AWWA C 115.
 - 1.2.3.8.4 AWWA C 151.
 - 1.2.3.8.5 AWWA C 153.
 - 1.2.3.8.6 AWWA C 214
 - 1.2.3.8.7 AWWA C 503.

- 1.2.3.8.8 AWWA C 509.
- 1.2.3.8.9 AWWA C 511.
- 1.2.3.8.10 AWWA C 600.
- 1.2.3.8.11 AWWA C 651.
- 1.2.3.8.12 AWWA C 900.
- 1.2.3.8.13 AWWA C 901.
- 1.2.3.8.14 UNI - B - 3 with AWWA C 900.
- 1.2.3.9 American Society for Testing and Material publications;
 - 1.2.3.9.1 ASTM C12 - Practice for Installing Vitrified Clay Pipe Lines.
 - 1.2.3.9.2 ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
 - 1.2.3.9.3 ASTM C425 - Compression Joints for Vitrified Clay Pipe and Fittings.
 - 1.2.3.9.4 ASTM C700 - Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated.
 - 1.2.3.9.5 ASTM D2321 - Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
 - 1.2.3.9.6 ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
 - 1.2.3.9.7 ASTM D2774 - Recommended Practice for Underground Installation of Thermoplastic Pressure Piping.
 - 1.2.3.9.8 ASTM D3034 - Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- 1.2.3.10 Sewer Purveyor Compliance: Comply with requirements of local sewer agency supplying sewer connections to project, obtain required permits and inspections.
- 1.2.3.11 Plumbing Code Compliance: Comply with applicable portions of National Standard Plumbing Code pertaining to selection and installation of storm sewage system's materials and products.
- 1.2.3.12 Environmental Compliance: Comply with applicable portions of local Environmental Agency regulations pertaining to storm sewage systems.

1.3 SUBMITTALS

- 1.3.1 Product Data: Submit manufacturer's technical product data and installation instructions for sewage system materials and products.
- 1.3.2 Record Drawings: At project close-out, submit record drawings of installed sanitary sewage piping and products, in accordance with requirements of Division 1.
- 1.3.3 Maintenance Data: Submit maintenance data and parts lists for sanitary sewage system materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual.

PART 2 – PRODUCTS

2.1 IDENTIFICATION

- 2.2.1 Underground-Type Plastic Line Markers: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; metallic-lined, not less than 6" wide x 4 mils thick. Provide green tape with black printing reading "CAUTION - SEWER LINE BURIED BELOW".

2.2.1.1 Available Manufacturers: Subject to compliance with requirements, manufacturers offering identification markers which may be incorporated in the work include, but are not limited to, the following:

2.2.1.2 Manufacturer: Subject to compliance with requirements, provide identification markers of one of the following:

2.2.1.2.1 Terra Tape Sentry Line 1350

2.2.1.2.2 Allen Systems, Inc.

2.2.1.2.3 Emed Co., Inc.

2.2.1.2.4 Seton Name Plate Corp.

2.3 PIPES AND PIPE FITTINGS

2.3.1 General: Provide pipes of one of the following materials, of weight/class indicated. Provide pipe fittings and accessories of same material and weight/class as pipes, with joining method as indicated.

2.3.2 Vitrified Clay Pipe: ASTM C 700, bell and spigot ends, standard strength unless otherwise indicated.

2.3.2.1 Fittings: Vitrified clay bell and spigot, same strength as adjoining pipe, compression joints complying with ASTM C 425.

2.3.3 Polyvinyl Chloride (PVC) Sewer Pipe: ASTM D 3033, Type PSP, SDR 35; or ASTM D 3034, Type PSM, SDR 35.

2.3.3.1 Fittings: PVC, ASTM D 3033 OR ASTM D 3034, solvent-cement joints complying with ASTM D 2855 using solvent cement complying with ASTM D 2564; or elastomeric joints complying with ASTM D 3212 using elastomeric seals complying with ASTM F 477.

2.3.4 Polyvinyl Chloride (PVC) DWV Pipe: Schedule 80, ASTM D 2665.

2.3.4.1 Fittings: PVC Schedule 80, ASTM D 2665; solvent-cement joints, ASTM D 2664; or threaded joints.

2.3 SANITARY SEWER MANHOLE

2.3.1 General: Provide pre-cast reinforced concrete sanitary manholes as indicated, and complying with ASTM C 478.

2.3.2 Top: Pre-cast concrete, of concentric cone, eccentric cone, or flat slab top type, as indicated.

2.3.3 Base: Pre-cast concrete, with base riser section and separate base slab, or base riser section with integral floor, as indicated.

2.3.4 Steps: Ductile-iron or aluminum, integrally cast into manhole sidewalls.

2.3.5 Frame and Cover: Ductile-iron, 26" diameter cover, heavy-duty, indented top design, with lettering cast into top reading "SANITARY SEWER".

2.3.6 Pipe Connectors: Resilient, complying with ASTM C 923.

2.4 CLEANOUTS

- 2.4.1 General: Provide as indicated, pipe extension to grade with ferrule and countersunk cleanout plug. Provide round cast-iron access frame over cleanout, with heavy-duty secured scoriated cover with lifting device.

PART 3 – EXECUTION

3.1 EXAMINATION

- 3.1.1 Verify that trench cut is ready to receive work, and excavations, dimensions, and elevations are as indicated on Drawings.
- 3.1.2 Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

- 3.2.1 Hand trim excavations to required elevations. Correct over excavation with fill material or sand.
- 3.2.2 Remove large stones or other hard matter, which could damage drainage pipe or impede consistent backfilling or compaction.
- 3.2.3 Install bedding as specified in Section 312300.

3.3 INSTALLATION OF IDENTIFICATION

- 3.3.1 General: During back-filling/top-soiling of storm drainage systems, install continuous metallic lined underground warning tape, located directly over buried line at 6" to 8" below finished grade. Tape shall be polyethylene with metallic core, 6 inches wide by 4 mils thick, solid blue color with continuously printed caption in black letters "CAUTION – SEWER LINE BURIED BELOW."

3.4 INSTALLATION OF PIPE AND PIPE FITTINGS

- 3.4.1 General: Install piping in accordance with Section 306, of the Standard Specifications for Public Works Construction. Seal joints water tight.
- 3.4.2 Surveyor Qualifications
 - 3.4.2.1 Surveyor shall currently be licensed in the State of California as a Professional Land Surveyor.
 - 3.4.2.2 Surveyor shall employ proper field procedures, instrumentation and adequate survey personnel in order to achieve accuracies as required by each section.
 - 3.4.2.3 Cut sheets, if required, shall be provide to the Inspector of Record at the start of the following business day after completion of the work.
- 3.4.3 Sanitary Sewer Staking:
 - 3.4.3.1 Stakes shall be located with positional accuracies of a minimum of 0.04 feet horizontally and 0.01 feet vertically.
 - 3.4.3.2 One set of construction stakes with lath shall be set. Lath shall indicate offset, cut/fill, and reference point, i.e. "TC", "FL".
 - 3.4.3.3 Stakes shall be provided for sewer lines at a maximum interval of 25 feet, grade breaks, angle points, manholes, cleanouts, clarifiers and building points of connection.

- 3.4.3.4 Construction stakes shall be offset to the side of the utility at a distance from centerline designated by contractor and agreed to by surveyor prior to commencement of staking.
- 3.4.3.5 Surveyor shall provide to the Inspector of Record cut sheets for all staking. The contractor shall not commence work until Inspector of Record has provided copies of said cut sheets.
- 3.4.3.6 All stakes shall be preserved in place until such time that the Inspector of Record has approved utility installation for backfilling.
- 3.4.3.7 All utilities to be installed at slopes less than 0.01 feet per foot shall be certified by the construction surveyor. Written certification shall be provided to the Inspector of Record and Construction Manager.
- 3.4.3.8 Should a dispute arise over the position of the utility in question and the stakes provided for said installation are removed, destroyed, or disturbed, the contractor assumes full responsibility for all cost associated with the resolution of the dispute.
- 3.4.4 Inspect piping before installation to detect apparent defects. Mark defective materials with white paint and promptly remove from site.
- 3.4.5 Lay piping beginning at low point of system, true to grades and alignment indicated, with unbroken continuity of invert.
- 3.4.6 Place bell ends or groove ends of piping facing upstream.
- 3.4.7 Install gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements.
- 3.4.8 Plastic Pipe: Install in accordance with manufacturer's installation recommendations, and in accordance with ASTM D 2321.
- 3.4.9 Cleaning Piping: Clear interior of piping of dirt and other superfluous material as work progresses. Maintain swab or drag in line and pull past each joint as it is completed.
 - 3.4.9.1 In large, accessible piping, brushes and brooms may be used for cleaning.
 - 3.4.9.2 Place plugs in ends of uncompleted conduit at end of day or whenever work stops.
 - 3.4.9.3 Flush lines between manholes if required to remove collected debris.
- 3.4.10 Joint Adaptors: Make joints between different types of pipe with standard manufactured adapters and fittings intended for that purpose.
- 3.4.11 Interior Inspection: Inspect piping to determine whether line displacement or other damage has occurred.
- 3.4.12 Make inspections after lines between manholes, or manhole locations, have been installed and approximately 2' of backfill is in place, and again at completion of project.
 - 3.4.12.1 If inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects, correct such defects, and re-inspect.
- 3.4.13 Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods for size and type material being closed. Wood plugs are not acceptable.

3.5 SANITARY MANHOLES AND CLEANOUTS

- 3.5.1 General: Place pre-cast concrete sections as indicated. Where manholes and cleanouts occur in pavements, set tops of frames and covers flush with finish surface. Elsewhere, set tops 2" above finish surface, unless otherwise indicated.
- 3.5.2 Spacing of manhole and cleanouts shall be a minimum as indicated by the Uniform Plumbing Code.
- 3.5.3 Form bottom of excavation clean and smooth to correct elevation.
- 3.5.4 Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections
- 3.5.5 Install in accordance with ASTM C 891.
- 3.5.6 Provide rubber joint gasket complying with ASTM C 443 at joints of sections.
- 3.5.7 Apply bituminous mastic coating at joints of sections.
- 3.5.8 Establish elevations and pipe inverted for inlets and outlets as indicated.
- 3.5.9 Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.6 TAP CONNECTIONS

- 3.6.1 Make connections to existing piping and underground structures, so that finished work will conform as nearly as practicable to requirements specified for new work.
- 3.6.2 Use commercially manufactured wyes for branch connections. Field cutting into piping will not be permitted. Spring wyes into existing line and encase entire wye, plus 6" overlap, with not less than 6" of 3,000-psi 28-day compressive strength concrete.
- 3.6.3 Branch connections made from side into existing 4" to 21" piping shall have wye sprung into existing line, and entire wye encased with not less than 6" of 3,000 psi 28-day compressive strength concrete.
- 3.6.4 Take care while making tap connections to prevent concrete or debris from entering existing piping or structure. Remove debris, concrete, or other extraneous material, which may accumulate.
- 3.6.5 Contractor shall be responsible for all coordination with the local sewer agency connections to be made to public mains.

3.7 BACKFILLING

- 3.7.1 General: Conduct backfilling operations of open-cut trenches closely following laying, jointing, and bedding of pipe, and after initial inspection and testing are completed.
- 3.7.2 To minimize local area traffic interruptions, allow no more than 100' between pipe laying and point of complete backfilling.

3.8 FIELD QUALITY CONTROL

- 3.8.1 Testing: Perform pressure testing of completed piping in accordance with the provisions of the project specifications prior to backfilling.
- 3.8.2 Request inspections by project Geotechnical Engineer during all backfill operations.

END OF SECTION

SECTION 221519 - GENERAL-SERVICE PACKAGED AIR COMPRESSORS AND RECEIVERS

1.1 SYSTEM DESCRIPTION

- A. Quality Standard for Receiver Tanks: ASME Boiler and Pressure Vessel Code.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design compressed-air equipment mounting.

1.3 MANUFACTURED UNITS

- A. Control Panels: Automatic control station with load control and protection functions.
 - 1. Automatic control switches to air compressors.
- B. Lubricated, Reciprocating Air Compressors:
 - 1. Air Compressor(s): One; two stage, piston type with lubricated compression chamber and crankcase.
 - 2. Mounting: Tank mounted.
 - 3. Receiver: Horizontal, steel tank.
- C. Inlet-Air Filters: Combination inlet-air filter-silencer for each air compressor(s).
- D. Aftercoolers: Air cooled.
- E. Compressed-Air Dryers: Refrigerant type.
- F. Wall-mounting, computer interface cabinet with internal wiring capable of interfacing 20 alarm signals.

END OF SECTION 221519

SECTION 22 20 00

PLUMBING SYSTEMS

~~Note to Engineers:~~

~~All fixtures and equipment must be shown on the drawings in a fixtures/equipment schedule. Refer to the Material Standards for Fixtures/Equipment. (This specification is for 5' outside to inside the building)~~

PART 1 – GENERAL

1.01 SUMMARY

- A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing and piping [and including the demolition and removal of certain existing fixtures, equipment, piping and appurtenances] all as required and as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Grossmont Union High School District (GUHSD).
- B. Provide fixtures and equipment which have been listed in the Material Standards by GUHSD.
- C. This section describes interior and {exterior} plumbing systems.
- D. Provide Plumbing Submittals and Shop drawings.
- E. A complete system of sanitary sewer piping and venting.
- F. Roof drains, overflow drains and rainwater piping systems.
- G. Complete domestic hot and cold water piping distribution system, including provisions for all plumbing fixtures and equipment. Provide connections to fixtures and equipment. Provide disinfection.
- H. Condensate system for HVAC equipment.
- I. Natural gas piping systems.
- J. Pipe hangers and other necessary support items.
- K. Plumbing equipment such as circulating pumps and water heaters.
- L. Excavating and backfilling.
- M. All Testing required and provide certificates.
- N. Record Drawings.

1.02 RELATED SECTIONS

- A. Section 22 01 00 Plumbing General Provisions
- B. Section 22 07 00 Plumbing Insulation

1.03 SUBMITTALS

- A. Comply with specification Section 22 01 00 Plumbing General Provisions.
- B. Required Submittals
 - 1. Plumbing fixtures and components.
 - 2. Plumbing equipment and accessories.
 - 3. Plumbing materials including piping, valves, and fittings.

1.04 REGULATIONS

- A. All work covered by this Section shall conform to the latest requirements of the following regulations:
 - 1. National Fire Protection Association.
 - 2. State Division of Industrial Safety.
 - 3. California Code of Regulations (CCR).
 - 3.4. **CalGreen: California Green Building Standards, CCR Title 24 Part 11, Chapter 5**
 - 4.5. California Plumbing Code (CPC), California Code of Regulations, Title 24, Part 5.
 - 5.6. California Fire Code, California Code of Regulations, Title 24, Part 9.
 - 6.7. County Health Department.
 - 7.8. Any other legally constituted bodies having jurisdiction thereof.
 - 8.9. California Building Code (CBC), Title 24, Part 2.
 - 9.10. Access plumbing fixtures shall comply with all of the requirements of CBC Section 1115B.
 - 10.11. Heights and location of all fixtures shall be according to CBC Table 1115B-1.
 - 11.12. Fixture controls shall comply with CBC Section 1117B.6.
- B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the GUHSD representative.

1.05 GENERAL

- A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories, which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices, which may be required to complete the installation.

- B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown.
- C. All permits; inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.
- D. See Drawings for Points of Connection.
- E. Certain site utilities are to be connected to and extended. Before laying of any pipe or digging of any trenches, Contractor shall determine by actual excavation and measurement exact location and depth of lines to which he is to connect. In event depth of lines is not sufficient to permit connection in manner indicated, obtain direction from the Owner's representative before proceeding with this work.
- F. Gas Service and Meter Assembly: Arrange with the serving utility company for the installation of new gas service with complete meter assembly of the capacity indicated and in the location as shown on the drawings. All items served with gas shall be adjusted while being operated at full fire. In cooperation with Gas Company, make all required adjustments to main gas pressure regulator and individual gas pressure regulators at each building. The GUHSD shall pay for all required fees.
- G. Before bidding on this work, make a careful examination of the premises to get thoroughly familiarized with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.
- H. Protect all work, equipment and materials at all times. Repair all damage caused either directly or indirectly by Contractor's workers. Close all pipe openings with caps or plugs during installation. Protect all equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.
- I. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the GUHSD Representative that his work has been accepted.
- J. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.
- K. Coordinate work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. In advance of the work, furnish instructions to the General Contractor for the requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.

- L. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to put identification numbers on fixtures and equipment schedules.
- M. Manufacturer's submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
- N. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.

A list of names is not a valid submittal. To be valid, all submittals must:

1. Be delivered to the GUHSD Representative within thirty-five (35) days of award of the contract. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.
 2. Include all pertinent construction, installation, performance and technical data.
 3. Have all copies marked to indicate clearly the individual items being submitted.
 4. Have each item cross-referenced to the corresponding specified item and be marked to show how differences will be accommodated.
 5. Contain calculations and other detailed data justifying how the item was selected for proposal. Data must be completed enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.
 6. Include, for every item, which differs in size, configuration, connections, service, accessibility, or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.
- O. Contractor shall not allow or cause any of his work to be covered up before it has been duly inspected, tested and approved by the GUHSD Representative or authorized inspectors having legal jurisdiction over his work. Should he fail to observe the above, he shall uncover the work and, after it has been inspected, tested and approved, recover it at his own expense.

- P. Requests for substitutions shall be in accordance with the requirements of Division I. Provide and perform tests required by Engineer for purpose of judging acceptability of proposed substitutions. Provide sufficient information to allow the Engineer to analyze any proposed alternate; the substitution will not be accepted and re-submittal will not be allowed if adequate information is not provided. The Contractor shall make all changes to the work of this trade and the work of all other trades resulting from a substitution at no additional cost to the District. The GUHSD Representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures, and materials; decisions of the GUHSD Representative shall be final and conclusive.
- Q. Provide record drawings in accordance with the requirements of Division 1.
- R. Keep up-to-date a complete "as-built" record set of prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work the as-built drawings shall be delivered to the GUHSD Representative. Upon approval the contractor shall make a digital scanned copy of the as built drawings. The scanned file name shall match the sheet number of the drawings.
- S. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the District.
- T. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.
- U. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship and shall not be less than one (1) year. See specific equipment specifications for extended warranty requirements.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All materials and equipment as indicated on the drawing, as specified, and required in the work shall be new and free from defects and imperfections.
- B. See the fixture and equipment schedules and notes on the drawings for additional information including manufacturers, model numbers, accessories, capacities, electrical data, weights, and installation requirements.

2.02 PIPE AND FITTINGS

- A. Soil and Waste System
 - 1. Piping below and above grade within the building and outside within five feet (5') of the foundation shall be Solid Wall Schedule 40 Polyvinyl chloride (PVC) Gravity Sewer Pipe and Fittings. Schedule 40 Solid Wall Polyvinyl chloride (PVC) DWV Gravity Sewer Pipe and Fittings. Solid wall PVC pipe and fittings shall be made by virgin PVC compounds meeting the ASTM D-2665. PVC shall comply with ASTM

D-1785. For glue joints, provide Weld-On #2721 medium bodied blue glue. Provide protection at penetrations of walls, floors, ceilings and fire resistance rated assemblies in accordance with ASTM E814. The "F" rating must be a minimum of the hourly rating of the fire resistance rated assembly that the plastic pipe penetrates.

~~B. Acid waste System~~

- ~~1. Acid waste pipe and vent pipe and fittings including "P" traps, strainer and tailpieces on the acid waste system shall be made by the Ipex Inc. (or equal by Orion) of Schedule 40 flame retardant polypropylene and shall be jointed with the Ipex Inc. "Enfield" system (provide mechanical joint at P traps only). All flame retardant polypropylene pipe and fittings shall conform to ASTM D635, UL test method subject 94 and the Ipex Inc.'s specifications.~~
- ~~2. Installation and testing shall be in accordance with the manufacturer's recommendations and the governing local code. Acid waste and vent piping under Building shall be same as specified for within building, except no mechanical joints. The entire acid waste system shall be installed and supported in strict accordance with manufacturer's recommendations. Underground piping shall be installed in six inch (6") sand base and six inch (6") sand cover prior to backfill.~~

~~G.B. Water System~~

1. Piping within the building and above grade shall be Type "L" ASTM B88, hard drawn copper tubing with wrought copper sweat fittings ANSI B16.22.
2. Water piping underground shall be Type "K" ASTM B88, hard drawn copper with wrought copper sweat fittings ANSI B16.22.
3. Water piping below the building floor shall be Type "K" soft annealed copper tubing with no fittings.

~~D~~-C. Natural Gas System

1. Piping within the building shall be Schedule 40 black steel pipe conforming to ASTM A53 using 150 pound banded malleable iron screwed fittings for piping 2" and smaller and weld type steel fittings for piping 2-1/2" and larger except all medium pressure gas shall be welded. Exposed gas piping outside the building shall be Schedule 40 galvanized steel pipe conforming to ASTM A53 using galvanized 150 pound banded galvanized malleable iron screwed fittings for piping in sizes 2" and smaller and seamless weld type steel fittings for all medium pressure gas piping and piping 2-1/2" and larger. All outdoor pipes shall be galvanized and shall be painted with oil base prime coat and oil base enamel finish to match exterior color.
2. Gas piping underground shall be Schedule 40 SDR-11 Polyethylene PE 2406 (Yellow) as manufactured by Performance Pipe. Fittings shall be socket fusion weld Polyethylene as manufactured by Performance Pipe or Central, PE 2406 (Yellow) complying with ASTM D2513. Where required provide "Lyco" or Double "O" seal transition fittings between steel and polyethylene as manufactured by Central, all identified and approved for gas service. A No. 16 copper tracer wire shall be installed with and attached to PVC piping and shall terminate above grade at each end. Gas piping extending to above grade, within valve yard boxes, below structures such as porches, steps, roofed patios, covered walks, uncovered walks adjacent to building or similar structures covered or uncovered shall be Schedule 40 steel pipe with 150 pound Buttweld fittings. Piping below concrete slab shall be installed within a schedule 40 PVC pipe sleeve extending between building and vented shut-off valve yard box. Galvanized pipe and fittings below grade shall be wrapped with 20 MIL identified polyethylene tape, two (2) layers, each half-lapped for a total thickness of 80 MILS. Underground polyethylene piping shall be installed by personnel certified by the pipe manufacturer as having received instructions directly from the pipe manufacturer's field representative.
3. Contractors not having certified personnel will be required to have a factory representative of the pipe manufacturer visit the site at the time of underground pipe installation and provide the required instructions. This Contractor will pay for all required cost for training and certification. Upon completion of the gas piping underground installation, this Contractor shall submit a written report directly to the GUHSD Representative stating that all materials installed are as specified and approved, that installation was done by factory certified personnel, that where required, steel pipe buried had received a minimum of 80 mils thick pipe wrap and finally that the entire system was wire traced, installed to a depth of thirty inches (30") within a sand bed and tested to 60 P.S.I.
4. Gas Risers: Provide gas risers with epoxy primer on coated transition fitting, wrap in 2 layers of tape (see buttweld fittings) and provide suitable size sleeve. Seal around pipe and sleeve with silicone sealant.

~~E~~-D. Storm Drain System

1. Piping and fittings shall be cast iron as specified for soil and waste piping. All exposed storm drain pipe and fittings shall be galvanized steel pipe as specified for exposed vent piping.

~~F~~-E. Indirect Waste Piping

1. Shall be the same as Soil and Waste Piping.

G.F. Condensate Drain System

1. Piping: (Air Conditioning units) shall be Type "M" copper as specified for water piping.

H.G. Compressed Air System

1. Piping: Shall be Type "L" copper as specified for water piping.

I.H. Exposed drain piping at plumbing fixtures shall be chrome plated yellow brass except exposed pipes in shop or utility areas.

J.I. Sump pump and sewage ejector discharge pipe and fittings shall be DWV copper pipe and fittings.

K.J. Unions or flanges shall be furnished and installed at each threaded connection to all equipment or valves. The unions or flanges shall be located so that the piping can be easily disconnected for removal of the equipment, tank, or valve, and shall be of the type specified in the following schedule.

1. Unions:
 - a. Black Steel Pipe: 250 pound screwed black malleable iron, ground joint, brass to iron seat.
 - b. Galvanized Steel Pipe: 250 pound screwed galvanized malleable iron, ground joint brass to iron seat.
 - c. Copper or Brass Tubing: 150 pound cast bronze or copper, ground joint, nonferrous seat with ends, by NIBCO or Mueller Industries.
2. Flanges shall be raised face 150 pound class forged steel, weld, neck or slip-on type conforming to ANSI B16.5 and ASTM A181. For copper piping systems, provide flanges conforming to ASME-ANSI B16.24. The faces of the flanges being connected to be alike in all cases. Locate flanges so that the piping can be easily disconnected for removal of the equipment or valve. Gasket material shall be of material suiting the service of the opening system in which installed and which conforms to its respective ANSI Standard (ANSI-AWWA C111/A21.11, ASME-ANSI B16.21). Provide materials that will not be detrimentally affected by the chemical and thermal conditions of the fluid being carried.

M. Underground cast iron, ductile iron, copper, steel or other metallic piping located both inside and outside of building shall be encased within a minimum of 10 mil polyethylene plastic sleeve sealed water tight with polyvinyl chloride tape. Sleeve shall terminate 3" above grade or floor slab.

N. Underground non-metallic piping shall have 16 gauge copper "Tracer Wire" continuous for entire length.

2.03 VALVES

A. Piping systems shall be supplied with valves arranged so as to give complete and regulating control of piping systems throughout the building, and locates so all parts are easily accessible and maintained.

A.B. All water and gas shut-off valves shall be installed above grade. Below grade installation is not acceptable.

B.C. Valve Design: Provide full port red brass ball valves. Gate valves are not allowed.

1. Sizes: Same size as upstream pipe, unless otherwise indicated.

C. Approved Manufacturers:

1. Hammond Valve
2. Watts
3. NIBCO
4. Apollo Valves

Provide Class 150 valves meeting the valve specifications where Class 125 valves are specified but are not available.

- D. Ball Valves, 2 Inches and Smaller: Hammond 8501, MSS SP-110, U.S. Safe drinking water act (SDWA) Rated for 150 psi saturated steam pressure, 600 psi WOG pressure; two-piece construction; with bronze body and single reduce bore or better, chrome plated solid brass ball, "Teflon" seats and seals, separate adjustable packing gland and nut, blowout-proof stem and vinyl covered steel handle.
- E. Gas Valves Hammond Ball Valve, 8901 UL, FM, MSS-SP-110, Rated at 150 wsp-600 WOG; UL listed, brass body, stainless steel ball, and threaded ends. Valve shall be C.S.A. certified.
- F. Swing Check Valves, (Hammond IB 944), MSS SP-80; Class 200, cast-bronze body and cap conforming to ASTM B61; with horizontal swing, Y-pattern, and bronze disc. Provide valves capable of being refitted while the valve remains in the line.
- G. Non-Slam Check Valves (Hammond IR 9253). Provide non slam check valves on the discharge of pumps. Check valves to be silent closing, class 125, iron body, bronze mounted spring leaded center guide, Miller, Williams Hager or Smolensky approved equal.

2.04 HOSE BIBBS

- A. Hose Bibbs shall be Acorn or approved equal, bronze body with chrome or nickel plated finish, with renewable composition disc, have loose key 3/4" hose end with 3/4" female inlet and vacuum breaker. Vacuum breaker shall conform to ASSE Standard 1011 with finish to match hose bibb.
- B. Recessed hose bibbs in wall box: Not allowed.
- C. Hose Bibbs shall be installed on walls under drinking fountains without a box.
- D. Hose bibbs shall be installed in landscaped areas where possible.

2.05 COMBINATION TEMPERATURE AND PRESSURE RELIEF VALVES

- A. McDonald, Watts, or approved equal, bronze body, test lever, thermostat, complying with ANSI Z21.22 listing requirements for temperature discharge capacity. Relief valves shall be factory set for 210 degree F. and 150 p.s.i. pressure. Relief valves shall be type as recommended by water heater manufacturer.

2.06 WATER PRESSURE REGULATORS

- A. Shall be of the manufacturer, model and sizes as indicated on the drawings, complete with shut-off valves (inlet and outlet of assembly), valve bypass, pressure gauges, strainers and pressure relief valves.

2.07 GAS PRESSURE REGULATORS

- A. Shall be of the manufacturer, model and sizes as indicated on the drawings. Regulators shall be installed above grade, in vaults shall be entirely corrosion proof and shall be protected by a cage approved by the Gas Company.

2.08 TRAPS, STRAINERS AND TAILPIECES

- A. Every sanitary fixture, unless otherwise specified, shall be provided with a seventeen (17) gauge tailpiece chromium tailpiece, a Los Angeles pattern chrome plated cast-brass trap, and wall flanges. Provide chromium plated brass casing between the trap and wall flanges with each fixture. All sanitary waste system floor drains (3 inch minimum) and floor sinks shall have cast iron "P" traps.

2.09 CLEANOUTS

- A. J.R. Smith, Zurn or Mifab cast-iron ferrule and countersunk brass clean-out plug with round cast iron access frame and heavy duty secured top cover.
- B. Wall Cleanouts: Zurn No. Z-1468 for steel pipe and Zurn No. Z-1446 for cast iron pipe.
- C. Floor Cleanouts: Zurn No. Z-1400, watertight ABS bronze plug and polished nickel bronze top.
- D. Cleanouts to Grade: Zurn Heavy Duty Clean-out Housing Z-1474 with bronze plug set flush with surface for concrete areas. Asphalt or non-surfaced areas shall be installed with ring of concrete poured around the bottom flange six inches (6") below surface. Use cast iron soil pipe on cleanout risers. For cleanouts in non-traffic areas, terminate cleanout plug in concrete yard box.
- E. Provide Enfield cleanout plugs for wall cleanouts on acid waste system.

2.10 ACCESS PANELS

- A. Wall access panels shall be minimum 14" x 14" for concealed valves and other equipment unless otherwise specified or indicated. Ceiling access panels shall be 18" x 18" minimum.
- B. Wall Panels: Elmdor, DW 14" X 14" – AKL, 14-gage Stainless Steel, Allen Key Latch, for all tile walls and dry wall walls in toilet rooms.
- C. Ceiling Panels Elmdor, DW 18" X 18" –SS-AKL, prime coated steel, type as required for plaster, or dry wall ceilings. Allen Key Latch.
- D. Fire Rated Walls: Elmdor, FR 14" X 14" –SS-CL, for all Fire rated tile walls and dry walls in toilet rooms provide stainless steel panels with cylinder Lock.

2.11 ROOF FLASHING

- A. Provide for all pipe penetrations through roof a Elmdor / Stoneman No. 1100-7, one (1) piece, six (6) pound, series with cast iron counterflashed and equipped with Vandal flash hood assembly for all vent piping. Seal joint between flashing and pipe with waterproofing compound.

2.12 FLUES

- A. Flues shall be double wall type "B" Metalbestos or approved equal, complete with tee, support, pipe collar, roof flashing, storm collar and top.

2.13 ESCUTCHEONS

- A. Shall be chrome plated cast brass with set-screw locking device or slip on.

2.14 WATER HAMMER ARRESTORS

- A. Provide where indicated on drawings of type indicated on equipment schedule and shall be sized per the manufacturer's recommendations. Install behind access panel.

2.15 DIELECTRIC UNION ISOLATORS

- A. Where incompatible materials come in contact, isolate from each other with material best suited for the characteristics of materials to be isolated. Dielectric union isolator for connection piping or non-compatible materials shall be of standard commercial design with threaded connections.

2.16 PIPE SUPPORTS

- A. The Contractor shall furnish and install all miscellaneous iron work including angles, channels, etc., required to appropriately support the various piping systems. Hanger spacing and location shall conform to California Plumbing Code requirements.
- B. All horizontal runs of piping within the building, except for copper water supply stub-outs at fixtures and copper supply headers within walls, to be supported from the structural framing with steel rods and split ring hangers: Cooper B-Line, Grinnell Company, Tolco, or approved equal. Copper stub-outs and copper headers within walls to be supported from the wall framing with Holdrite pipe hangers and supports as specified at item 9, below. Steel rods shall be secured to overhead framing with side beam connectors. Where necessary, install angle iron between framing to accommodate hanger rods. Where several pipes are running together, Unistrut, Copper B-Line, or Powerstrut channels with clamps may be used in lieu of individual pipe hangers, and supported from structure as herein specified. Submit test data for type of hanger supports to be provided. For support conditions other than specified herein, the Contractor shall submit method of support for approval prior to any installation.
- C. Makeshift, field devised methods of plumbing pipe support, such as with the use of scrap framing materials, are not allowed. Support and positioning of piping shall be by means of engineered methods that comply with IAPMO PS 42-96. These shall be Hubbard Enterprises/HOLDRITE support systems or Owner-approved equivalent.
- D. Provide factory fabricated horizontal hangers and supports complying with one of the following MSS types listed to suit horizontal piping systems, in accordance with MSS SP-69, IAPMO PS 42, and manufacturer's published information. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems.
 - 1. Adjustable Steel Clevis Hangers: (MSS Type 1) B-Line B 3100
 - 2. Adjustable Swivel Pipe Rings: (MSS Type 5) B-Line B 3690
 - 3. Split Ring: (MSS Type 11)
 - 4. Pipe Alignment and Support Brackets: (Per IAPMO PS 42) HOLDRITE products (see section.9.)

- E. Provide factory fabricated vertical-piping clamps complying with the following types listed, to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.
1. Two-Bolt Riser Clamps: (MSS Type 8) B-Line B3373
 2. For vertical mid-span supports of piping 4" and under, use Hubbard Enterprises/HOLDRITE Stout Brackets™ with Hubbard Enterprises/HOLDRITE Stout Clamps or two-hole pipe clamps (MSS Type 26).
- F. Provide factory fabricated hanger-rod attachments B-Line, Tolco or approved equal, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with ANSI-MSS SP-58 and manufacturer's published product information. Select size of hanger-rod attachment to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.
1. Side beam eye socket, Tolco Fig. #57 for rod sizes 3/8" dia. and Tolco Fig. #25-30-251 for rod sizes 1/2" dia.
- G. Provide factory fabricated building attachments, selected by Installer to suit building structural framing conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems.
1. For existing concrete construction, provide expansion shields.
- H. Hanger Rods and Spacing shall conform to the following table:
- | <u>Pipe Sizes</u> | <u>SpacingRods</u> | |
|----------------------|--------------------|----------|
| 2 Inch and Smaller | 6 Feet | 3/8 Inch |
| 2-1/2 Inch to 3 Inch | 8 Feet | 1/2 Inch |
| 4 Inch and larger | 8 Feet | 5/8 Inch |
- I. Hangers and Supports shall be adequate to maintain alignment and prevent sagging and shall be placed within 18 inches of joint. Support shall be provided at each horizontal branch connection.
- J. When securing copper water supply piping directly to the DWV piping or to the wall framing (horizontal water headers and fixture stub-outs), the following copper-plated components of the "HOLDRITE" system are to be used as a support system:
1. For positioning supply/flush valve for wall-hung water closet, use model 114C (attaches to carrier) and 114C-EXT (extension for above, e.g., for fixtures to be used by handicapped).
 2. For attachment to wall framing, use models 101-26, 102-26.
- K. Provide lateral bracing as manufactured by B-Line or approved equal for all piping to prevent swaying or movement in accordance with SMACNA "Seismic Restraint Manual: Guideline for Mechanical Systems". Piping smaller than indicated in the guidelines shall be provided with bracing as specified for the smallest size indicated. The entire water distribution system shall be properly braced and will not move due to the action of quick closing of valves.

- L. Miscellaneous Supports, Wall Brackets, Etc.: Provide where required in accordance with the best standard practices of the trade. Submit shop drawings for all fabricated supports where engineered supports are not available.
- M. 2.17.13 Isolators: All water piping shall be installed with a manufactured type isolator. Isolators shall be B-Line vibra clamp and cushion, Elmdor/ Stoneman, "Trisolator", or approved equal. Piping shall be installed and supported in a manner to provide for expansion without strains. Guides shall be properly installed to ensure this requirement.
- N. Shields: Provide 20 gauge galvanized sheet metal shields at piping hangers for all insulated piping. Size shields for exact fit to mate with pipe insulation.
- O. Roof Mounted Piping: Pipe supports installed on roof shall be as manufactured by PHP Systems, Model No. PP10 with galvanized metal strut or approved equal. Support shall include all required clamps and devices for a complete system. Set base in adhesive onto clean roof surface in accordance with manufacturers' installation instructions. Proposed installation procedure shall have approval of roofing contractor. Alternate system shall be Pipe Pier, flexible resilient closed-cell polyethylene foam (ETHAFOAM brand - trade mark of the Dow Chemical Company), with strut system built into foam block.

2.17 FIXTURES

- A. See schedule on drawings.
- B. Accessible plumbing fixtures shall comply with all of the requirements of California Building Code Section 1115B. Heights and locations of all fixtures shall be according to California Building Code Section 1115B.4 and DSA Check List Fig. 15-A. Fixture controls shall comply with California Building Code Sections 1115B.4.4.4 for showers, 1115B.4.3, Item 1 for lavatories, 1115B.4.1, Item 5 for toilets, and 1115B.4.2, Item 3 for urinals. 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. Fixtures:
 - 1. All floor drains shall be minimum 3" sanitary sewer pipe outlet.
 - 2. Furnish complete with necessary trim, including stops. All trim and fittings shall be chrome-plated brass including handles, supply tailpieces, traps and escutcheons.
 - 3. Connections to fixtures shall be in accordance with code requirements except as exceeded herein or on the drawings and in no case less than the supply stop size.
 - 4. All plumbing fixture faucets submitted for review shall have identification label or certification showing compliance with California TITLE 24, PART 5, ARTICLE I, "Energy Conservation Standards". ARTICLE I, T20-1406; ARTICLE 2, T20-1525 and ARTICLE 4, 1604 and 1606.
 - 5. Minimum waste sizes shall be four inch (4") for water closets and two inch (2") for lavatories.
 - 6. Steel plate supports shall be provided for all wall hung fixtures. Supports shall be 3/8 inch thick x 6 inch wide steel plates recessed and lag screwed to wood studs or welded to steel studs and tapped for fixture bolts. Length and number of plates as required to satisfactorily support the fixtures installed.
 - 7. **Water closets shall be of the floor mounted type. Wall hung water closets shall not be acceptable.**

- 6-8. Drinking fountains shall be non-cooled double bowl type with minimum of (1) accessible bowl [with water bottle filler by Elkay EZH20].

2.18 WATER HEATERS AND HOT WATER CIRCULATING PUMPS

- A. See equipment schedule on drawings
- B. Water heaters shall be in Compliance with ASHRAE 90.1.
- C. Hot water circulating pumps
 - 1. Provide all bronze or stainless steel in-line circulating pump of size and capacity as scheduled on the drawings.
 - 2. Pump to have integral thermal overload protection
 - 3. Provide "Aquastat" (pipe line heat sensitive thermostat) and 24 hour time clock for on/off operation.

~~2.19 LABORATORY (ACID WASTE AND SERVICE PIPING)~~

- ~~A. The Contractor shall run all service lines, rough-in and make final connections to all laboratory and workroom equipment. The work shall include furnishing, installing and connecting of all service lines, drain lines, piping within equipment in service turrets, hoods, through, under or along the backs of working surfaces and in reagent racks above countertops as required and indicated by Laboratory equipment manufacturer.~~
- ~~B. The Contractor shall also install sinks complete with all required trim including faucets, coocks, sinks, strainers, and other devices furnished under Laboratory Equipment Section. Furnish and install all vents and revents from traps to point of discharge. All sink tailpieces and traps shall be furnished and installed by Plumbing Contractor. Traps shall be "P" type of same material as acid waste system. The Contractor shall cooperate with the Laboratory Casework Contractor to provide a complete system, and that the Contractor shall include all necessary work (labor and/or materials or both) as required to complete the installation whether or not shown on the drawings or specified herein at no added cost to the Owner.~~

~~2.20 KITCHEN EQUIPMENT & FIXTURES~~

- ~~A. Run all service lines, furnish and install rough-in and make final connections to all fixtures and equipment provided by Kitchen Equipment Contractor.~~
- ~~B. The work shall include installing and connecting of all sinks, garbage disposals, drain lines, piping within equipment, through, under or along the backs of working surfaces as required and indicated by equipment manufacturer, Plumbing Contractor shall furnish and install all tailpieces, P-traps, hot and cold water stops, gas coocks as required for Kitchen Equipment furnished sinks and equipment.~~
- ~~C. The Contractor shall also furnish and install sinks and equipment as indicated on plumbing drawings complete with all required trim including faucets, stops, coocks, and P-trap and strainers.~~
- ~~D. Furnish and install all required vents and re-vents from traps, and all required indirect waste lines. All exposed piping and fittings shall be chrome plated, with the exception of drain line and P-trap serving garbage disposals that are larger than 2 inch in size. Sizes larger than 2 inch shall have type L copper drain and copper P-trap compete with union connections.~~

PART 3 - EXECUTION

3.01 FIXTURE INSTALLATION

- A. Water piping and drain connections shall not be smaller than the sizes allowed by the plumbing code.
- B. Furnish all fixtures complete with supplies, individual stops, traps, escutcheons, trim and all other accessories to provide a complete fixture. Fixtures shall be set in place and secured to walls. Provide ADA trap and piping wrap at lavatories and sinks per ADA requirements.
- C. All plumbing fixtures shall be bedded and caulked along joint at walls, countertops, and other intersecting surfaces with DAP Kwik-Seal Tub and Tile adhesive caulk. DAP package code number shall be 18001 white caulk.
- D. Caulk around the bases of toilets, urinals and vitreous china sinks.
- E. All faucets to be installed using "Plumber Putty" under the base of the faucet for a watertight seal.
- F. Plumbing fixture trim and exposed supplies and waste shall be brass with polished chrome plated finish. Polished chrome plated piping, fittings, and valves shall not bear tool marks.
- G. Provide backing for each plumbing fixture requiring same, at the time roughing-in is done.
- H. After the fixture installation is complete, cover and protect the rims, front, and all exposed parts until the completion of the construction phase. The plumbing contractor shall be responsible for all damage to fixtures, and shall assume all related costs.

3.02 LOCATIONS AND ACCESSIBILITY

- A. Sleeves for piping through masonry walls or floors shall extend completely through the walls or floors. Sleeves shall finish flush on both sides. Provide risers clamps at all floor penetrations.
- B. Unions shall be installed after each screw-type valve, connections for all equipment, appliances and as required for erection and maintenance. No unions shall be installed in concealed location.
- C. All condensate drains to have clean-outs at each horizontal run. Clean-outs shall be F.I.P. thread brass plugs.
- D. All roof drains shall be graded at a minimum of 1/4" per foot unless other wise noted on the drawings. The sections of the pipe shall be laid and fitted so when completed the sewer will have smooth and uniform invert.
- E. All sanitary sewers, sanitary waste, grease waste and condensate lines and shall be graded at a minimum of 1/4" per foot unless other wise noted on the drawings. The

sections of the pipe shall be laid and fitted so when completed the sewer will have smooth and uniform invert.

- F. Site natural gas piping shall have a minimum of 30" of cover or be 30" below finished floor. Provide tracer wire around pipe. Tracer wire shall be 14 gauge copper wire with plastic covering. Tracer wire shall extend 6 inches above grade at the ends of the piping systems. Provide warning tape a minimum of 18" above pipe.
- G. Install equipment for ease of maintenance and repair. If changes in the indicated locations or arrangements are made by the Contractor, they shall be made without additional charges.
- ~~G.~~H. **Install shut-off water and gas valves at each self-standing structure to allow for isolation from the main system. Locate valves above grade. Valves located under grade are not acceptable.**
- ~~H.~~I. Openings: Furnish information to the other trades on size and location of openings which are required in walls, slabs, roof, for piping and equipment at the proper times.
- ~~I.~~J. Closing-In of Uninspected Work: Do not allow or cause any of the work to be covered up or enclosed until it has been inspected, tested, and accepted by the GUHSD Representatives. Any work enclosed or covered prior to such inspection and test shall be uncovered and, after it has been inspected, tested, and approved, make all repairs with such materials as may be necessary to restore all work, including that of other trades, to its original and proper condition.
- ~~J.~~K. Before laying of any pipe or digging of any trenches, Contractor shall determine by actual excavation and measurement exact locations and depth of existing utility and service lines to which he is going to connect. Should existing conditions prevent for installation of piping as detailed on drawings or to make connection in manner indicated, Contractor shall confer with the GUHSD Representative for Direction.

3.03 EXCAVATION, TRENCHING AND BACKFILL

- A. Do all necessary trench excavation, shoring, backfilling and compaction required for the proper laying of the pipe lines. Remove all surplus earth materials from site.
- B. Backfill shall be clean soil free from rocks and debris. Compact to ninety percent (90%) of surrounding soil. All piping both inside and outside of building shall be installed in a minimum 6" sand bed and covered with 6" of sand prior to backfill. Continue backfill with materials free of rocks and debris, properly moistened and mechanically tapered and compacted to 90% of surrounding soil. Compaction by flooding or jetting is expressly prohibited.
- C. Water, soil and waste piping shall have twenty-four (24") of cover minimum, ~~fire main shall have thirty six (36") of cover~~ except all PVC pipe material and all gas piping shall have thirty (30") of cover minimum. All other pipe shall have not less than eighteen inches (18") of cover, unless otherwise noted on the drawings. Offset gas and water piping as required to permit crossover of underground piping systems, and electrical conduit systems.
- D. Bottoms of Trenches: Cut to grade and excavate bell holes to ensure the pipes bearing for their entire length upon the outside periphery of the lower third of the pipe.
- E. Trees: When it is necessary to excavate adjacent to existing trees, the Contractor shall use all possible care to avoid injury to trees and roots. Where a ditching machine is run close to trees having roots smaller than 2" in diameter, the wall of the trench adjacent to the trees shall be hand trimmed making clean cuts through the roots. All cuts through roots 1/2" and

larger in diameter shall be painted with "Tree-Seal", or equal. Trenches adjacent to trees should be filled within 24 hours after excavation, but where this is not possible, the side of the trench adjacent to the tree shall be kept shaded with burlap or canvas. Stockpiling of earth or building materials within the drip line of trees is prohibited. Where any roots 2" and larger are encountered, the Contractor shall hand tunnel under root and protect it by burlap wrapping.

- F. Water piping shall not be run in the same trench with sewer or drainage piping unless separated as required by the UPC as follows. The bottom of the water pipe at all points shall be at least twelve (12) inches above the top of the sewer or drain line. The water pipe shall be placed on a solid shelf excavated at one side of the common trench with a minimum clear horizontal distance of at least twelve (12) inches from the sewer or drain line.
- G. No piping shall run in, through or above any electrical equipment rooms or spaces at any time.
- H. Horizontal soil and waste piping shall be installed to a uniform grade of not less than one fourth inch (1/4") per foot, unless otherwise indicated or directed.

3.04 PIPING INSTALLATION

- A. Piping shall be concealed in finished portion of the building except where otherwise indicated or directed at the time the work is done. All piping shall be installed to clear all framing members and beams, even if drawings do not indicate same. Contractor shall constantly check the work of other trades so as to prevent any interference with the installation of this work.
- B. Piping into stem walls and footings shall be double half lap wrapped with 1/8" thick "Armaflex" insulation. The Contractor shall also provide blocked out areas in stem wall and footing as required for the installation of the piping. All piping shall avoid the lower 8" of the footing and the Contractor shall coordinate and provide dropped footings as required for the installation of the underground piping.
- C. Unions shall be installed on one side of all screwed shut-off valves, at both sides of screwed automatic valves and on all by-passes, at all equipment connections and elsewhere as indicated or required for ease of installation and dismantling.
- D. Connections between copper tubing and equipment shall be with Mueller Industries, or approved equal, brass stream-line copper to P.P.S. ground joint unions.

3.05 CORROSION PROTECTION

- A. All underground metallic piping such as cast iron (soil & storm drain), ductile iron (fire protection), copper (Water) or steel (gas) located both inside and outside of the building shall be encased within a minimum of 10 mil polyethylene plastic sleeve.
- B. All underground metallic valves, unions, fittings, flanges, bolts & appurtenances that are unable to be encased within sleeve as noted above shall be protected as follows.
 - 1. Provide heavy coating of "Henry's" oil base roof mastic over entire exposed surface.
 - 2. After mastic coating is completed and inspected, wrap entire metallic component with a minimum of 10 mil. Polyethylene wrap overlapped 50% of the circumference and extended beyond ends of component as required for polyethylene to be

secured to piping. The overlap seam shall be located to avoid backfill material from entering the encapsulated area. The ends and seam of the of the polyethylene material shall be secured to the piping and sealed with 3M Scotch/Wrap N. 50, 10 mil., 2" wide, printed, pipe wrap sealing tape.

3. The mastic coating shall be inspected and approved prior to the finish application of the polyethylene material, which shall also be inspected.

3.06 SLEEVES

- A. Shall be schedule 40 galvanized steel where pipes pass through concrete foundation walls and 22 gauge galvanized sheet metal in all other walls, floors and partitions.
 1. Isolate pipes through ground floor slabs with double wrap Kraft paper, unless pipe sleeves as specified above as indicated or required by code.
 2. Pack space between pipe and sleeves with ceramic fiber rope so as to be absolutely watertight.
 3. All sleeve penetrations in or through fire rated stud walls, ceilings or floors shall be protected & sealed per U.L. Fire Resistance System No. WL1001 for uninsulated pipe and No. WL5039 for insulated pipe. All sleeve penetrations in or through fire rated concrete/masonry walls, ceilings or floors shall be protected and sealed per U.L. Fire Resistance System No. C-AJ-1116 for un-insulation pipe and No. C-AJ-5002 for insulated pipe. See architectural plans for all locations of rated walls and other fire rated assemblies.
 4. Hanger rods required to pass through fire rated finished ceilings shall be protected as specified here in above and an escutcheon plate provided at face of penetration.
- B. Contraction and Expansion: Install all work in such a manner that its contraction and expansion will not do any damage to the pipes, the connected equipment, or the building. Install offsets, swing joints, expansion joints, seismic joints, anchors, etc., as required to prevent excessive strains in the pipe work. All supports shall be installed to permit the materials to contract and expand freely without putting any strain or stress on any part of the system. Provide anchors as necessary.
- C. Pipe Joints and Connections:
 1. Copper Tubing and Brass Pipe with Threadless Fittings:
 - a. Solder joints for copper shall be made with 95/5 lead free solder in accordance with manufacturer's recommendations for the service intended and shall be NSF-ANSI Standard 61 certified approved.
 - b. Use threaded adapters on copper tubing where threaded connections are required.
 2. Welded Joints: All welding to be performed by welders certified as passing ASME Boiler and Pressure Code (Section IX) and shall comply with ASME Std. B31.1.0 and the American Welding Society, Welding Handbook.
- D. All closet bends shall be adequately blocked and secured. Trap arms and similar connections installed below the floor level or under concrete slabs shall be adequately supported and anchored to prevent motion in any direction. All piping installed above grade within buildings shall be secured to structural framing with Unistrut or pipe clamps to

provide a rigid installation. Piping utilizing gaskets as a seal shall be given prime consideration to providing adequate stability through proper supports and anchors because of its flexible nature.

- E. Flexible piping of any kind will not be permitted except when indicated on drawings provide Hose Master Inc., flexible pipe appliance connector model UNP, female union, male nipple and plastic cover, AGA approved for kitchen equipment only.
- F. Each pipe penetration of the roof shall be separated from other piping and any roof equipment by a minimum of 18" to insure a proper pipe flashing installation.
- G. Floor, Wall and Ceiling Plates: Where pipes pierce finished surfaces, C.P. brass split flanges with set screw lock shall be provided.
- H. Roof Flashings: Extend pipe a minimum of seven inches (7") above finished roof line, except where a vandal proof hood is required in which case pipe shall extend to a height required to receive the hood and also where specifically required to exceed this dimension by the local authority due to snow conditions.
- I. Installation of Plumbing Fixtures:
 - 1. Install each fixture at the exact height and location shown on the Architectural Drawings.
 - 2. Set fixtures, supplies, trap and trap outlet square with the wall, in line with fixture outlets without any offsets, angles, or bends.
 - 3. Grout joint between the fixtures and the walls or floors with polysulfide or silicone sealant to be smooth, even and watertight.
 - 4. Watertight joints for drainage connections to all fixtures shall be made in accordance with the California Plumbing Code.
- J. Completion of Installation:
 - 1. Cleaning and Flushing: Clean all equipment and materials thoroughly. Leave surface to be painted smooth and clean, ready for painting.
 - 2. Flush each unit of water supply and distribution system thoroughly with clean water at the highest velocities attainable.
 - 3. Clean all piping, valves, traps, water heaters, fixtures and other devices thoroughly and flush or blow out until free of scale, oil silt, sand, sediment, pipe dope and foreign matter of any kind.

3.07 CUTTING & PATCHING

- A. The cutting and patching of existing construction shall be coordinated in advance of the work.
- B. Where required to remove, cut or core drill existing building walls, partitions, floors, ceilings and roof and outdoor paved and landscaped areas in order to install the work as indicated, the Contractor shall cut and patch existing construction to match adjacent areas in a manner that will not result in visual evidence of any cutting or patching. The materials, finishes and methods of installation shall match the existing adjacent surfaces and shall be in accordance with the requirements of other applicable sections of these specifications.

- C. Unless specified on structural drawings, any alterations or modifications to a structural element by cutting, drilling, boring, bracing, welding, etc., shall have written approval by Structural Engineer of record and DSA prior to start of work.

3.08 STERILIZATION OF DOMESTIC WATER LINES

- A. Sterilize water lines by filling with a solution containing fifty (50) parts of chlorine per million parts water and holding the solution therein for at least twenty-four (24) hours with a water head of at least five feet (5') above the highest point in the system. Unless otherwise directed, thoroughly flush each line prior to sterilization. Introduction of sterilizing solution or materials into the lines shall be such as to provide thorough and uniform distribution throughout the system.
- B. Operate all valves during the retention period. Following retention period, the heavy chlorinated water shall be flushed from the system with clean water.
- C. Continue flushing until the residual chlorine at the end of 24 hours does not exceed the chlorine residual in the flushing water.
- D. All work and certification of performance must be done by an approved laboratory utilizing qualified applications and personnel.

3.09 TESTING

- A. No piping work shall be concealed or covered until piping has been tested, inspected and approved by the Inspector. All piping for plumbing systems shall be completely installed and tested as required by the California Plumbing Code. Test pressures and times indicated are a minimum only. All tests shall be as required by the governing authority as well.

Schedule of Test Pressures:

<u>System Tested</u>	<u>Gauge</u>	<u>Test</u>	<u>Duration</u>
Water	100 Pounds or 1½ times working pressure whichever is greater.	Water	8 Hours
Gas	60 Pounds	Air	8 Hours
Air	150 Pounds	Air	8 Hours
Waste, Vent &	Minimum 10 Feet of Head	Water	8 Hours
Storm Drain	Minimum 10 Feet of Head	Water	8 Hours

3.10 OPERATION INSTRUCTION

- A. Prior to occupancy or prior to the date of final inspection, whichever may occur first, the Contractor shall prepare two (2) sets of typewritten instructions for the operation of all equipment, valves, etc., specified and furnished as a part of the work under this section, and shall assign a competent person, thoroughly familiar with the job, to demonstrate and instruct a representative of the Owner in the operation of the equipment. The time of said demonstration and instructions shall be arranged with the Owner's representative approximately one (1) week in advance. Verbal instructions shall include shut-off location of gas and water. The Contractor shall assemble all operation and maintenance data supplied by the manufacturers of the various pieces of equipment, all keys and special wrenches required to operate and service the equipment (including keys for yard boxes, gas stops and fixture stops), and all equipment warranties and deliver same to the representative of the Owner on date of said instructions.

3.11 PIPE AND EQUIPMENT IDENTIFICATION

- A. Each operating and service line shut-off valve shall be identified by a 19 ga. brass tag with stamped, engraved type of service identified, complete with a hole and brass chain mounted on valve stem or handle. Tag shall be a minimum of one and one-half inch (1½ ") in diameter. The contractor shall provide valve chart (framed and mounted in Custodial Room) with size, type and location of all shutoff valves. Valves shall be numbered to match corresponding valve tag.
- B. Access Panel Markers: Provide manufacturers standard 1/16 inch thick engraved plastic laminate marker, with abbreviations and numbers corresponding to concealed valve.
- C. Provide on exterior wall of each building opposite the building's main gas service a sign reading "Gas Shut Off". Sign shall be metal with minimum 1½ " high embossed letters.
- D. All equipment shall be provided with name plate indicating all pertinent information on it.
- E. Manufacturer's (Seton or Brandt) standard permanent, bright colored, continuous printed plastic tape, intended for [all interior piping and] direct-burial service, piping not less than 6 inches wide x 4 mils thick. Provide multi-ply tape consisting of solid aluminum foil core indicating type of service of buried pipe between two layers of plastic tape. The warning plastic (service identified) tape shall be placed one (1) foot above all buried pipe.

3.12 SCHEDULING OF WORK:

- A. The facilities will be in operation during the entire period of construction. The Contractor shall be responsible for the proper scheduling of his work to insure that the existing mechanical systems to be replaced, modified and extended into existing utilities are kept in operation during the entire period of construction. When interrupted service are unavoidable, the Contractor shall confer with the Owner's authorized representative to determine at what times the connections can be made to minimize the interruptions to the normal operation of the facilities.
- B. Certain piping and equipment are presently insulated and asbestos compounds. The work required for this asbestos removal will be the responsibility of the Owner and shall be in full compliance with all governing authorities. The Owner shall certify that all asbestos removal has been completed prior to contractor's start of work.

3.13 DEMOLITION

- A. General: Provide all work necessary for demolition, dismantling, cutting & alterations as indicated, specified and required for completion of the work. The work shall include but not be limited to the following major items.
 - 1. Protection of existing work to remain.
 - 2. Disconnecting & capping sewers.
 - 3. Removal of items as indicated on drawings.
 - 4. Salvageable items to be retained by Owner.
- B. Project Site Conditions:
 - 1. Drawings may not indicate in detail all demolition to be carried out. Contractor shall carefully examine existing work to determine full extent of demolition required for completed work to conform to drawings and specifications.
 - 2. Existing work to remain that is damaged during and by demolition operations shall be repaired or replaced to satisfaction of the Owner at no cost to the Owner.

3. Contractor shall be solely responsible for damage resulting from inadequate or improper support demolition procedures including dust containment.
- C. Coordinate:
1. Prior to commencement of work, contact the owner's representative to confirm that all items identified to be removed are clearly marked.
 2. Coordinate demolition with other trades to ensure correct sequence, limits, and methods of proposed demolition. Schedule work to create least possible inconvenience to operation of the facility.
- D. Salvage: The Owner's representative shall determine with the contractor certain items that are to be kept by the Owner & these items shall be taken by the contractor to a place of storage as directed by the Owners. All other demolition items shall be removed from the premises by the contractor.
- E. Protection:
1. Do not demolition until temporary, barricades, warning signs and other forms of protection are installed.
 2. Provide all safeguards, including warning signs and lights, barricades, and the like during demolition.
 3. Noise, Dust and Water Controls: Containment shall be provided as required.
 4. Safety: If at any time safety of existing construction appears to be endangered, Contractor shall take immediate measures to support such endangered construction; operations and immediately notify the Owners representative.
- F. Removal of Existing Plumbing, Piping, Fixtures, And Services: Contractor shall remove from site existing piping, plumbing equipment, fixtures and services not indicated for reuse and not necessary for completion of work. Cap services to their portion of work prior to commencement of, or during work of, this section.
- G. Patching: Patch materials, which are to remain when damaged by this work. Finish material and appearance of patch or repair work shall match existing contiguous materials and finishes in all respects
- H. Clean-Up/Disposal: Debris waste, and removed materials, other than items to be salvaged, are Contractor's property for legal disposal off site. Continuously clean up and remove these items and do not allow accumulating in building(s) or on site.

Plumbing fixtures:

- Plumbing fixtures and accessories provided in a toilet room or bathing room required to comply with **CBC Section 11B-213.2** shall comply with **CBC Section 11B-213.3**.
- Effective March 1, 2017, all single-user toilet facilities shall be identified as Gender Neutral facilities by a door symbol that complies with **CBC Sections 11B-216.8 and 11B-703.2.6.3**. No pictogram, text or braille is required on the symbol. If tactile jamb signage is provided, the signage shall comply with the appropriate technical requirements of **CBC Section 11B-703**. Examples of appropriate designations are "ALL-GENDER RESTROOM", "RESTROOM" or "UNISEX RESTROOM". **DSA BU 17-01**.
- Accessible plumbing fixtures shall comply with all the requirements in **CBC Division 6**.
- Clearance around accessible water closets and in toilet compartments shall be 60 inches minimum measured perpendicular from the side wall and 56 inches minimum measured perpendicular from the rear wall per **CBC Section 11B-604.3.1**.
- Heights and location of all accessible fixtures shall be mounted according to **CBC Sections 11B-602 through 11B-612**.
- Accessible fixture controls shall comply with **CBC Sections 11B-602.3** for drinking fountains, **11B-604.6** for water closets, **11B-604.9.5** for children's water closets, **11B-605.4** for urinals, **11B-606.4** for lavatories and sinks, **11B-607.5** for bathtubs, **11B-608.5** for showers, and **11B-611.3** for washing machines and clothes dryers.
- Accessible lavatories and sinks shall be mounted with the front of the higher of the rim or counter surface 34" maximum above the finish floor or ground. Depth of lavatories or sinks shall not interfere with knee and toe clearance provided in accordance with **CBC Section 11B-306** when a forward approach is required. **CBC Sections 11B-606.3 and 11B-606.7**
- Water supply and drain pipes under accessible lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under accessible lavatories and sinks. **CBC Section 11B-606.5**

END OF SECTION

SECTION 226219 - VACUUM EQUIPMENT

1.1 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent testing agency that is an NRTL.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Vacuum equipment mounting.
- B. Seismic Performance: Vacuum equipment shall withstand the effects of earthquake motions.

1.3 MANUFACTURED UNITS

- A. Control Panel: Automatic control station with load control and protection functions.
 - 1. Automatic control switches to vacuum pumps.
- B. Receiver Tanks: ASME Boiler and Pressure Vessel Code.
- C. Mounting Frames: Resist movement during a seismic event when base is anchored to building structure.
- D. Lubricated, Reciprocating-Piston Vacuum Pumps:
 - 1. Vacuum Service: General vacuum.
 - 2. Vacuum Pump(s): One.
 - 3. Mounting: Tank mounted.
 - 4. Receiver: Vertical steel tank.

1.4 INSTALLATION

- A. Vibration Isolation: Equipment installed with concrete equipment base on restrained-spring isolators.

END OF SECTION 226219

SECTION 23 01 00

HEATING, VENTILATING AND AIR CONDITIONING SYSTEMS GENERAL PROVISIONS

~~Note to Engineers: —~~

~~All Equipment must be shown on the drawings in an equipment schedule. Refer to Division 23 Specifications and Material Standards.~~

PART 1- GENERAL

1.01 SUMMARY

- A. Provide items, articles, materials, operations and methods listed, mentioned and scheduled on drawing and specifications, including labor, materials, equipment, and incidentals necessary or required for the completion, testing, inspection, adjusting, re-testing and readjusting to provide the various systems operable and complete in all respects.
- B. Provide fixtures and equipment which have been listed in the Material Standards by Grossmont Union High School District (GUHSD).

1.02 RELATED SECTIONS

- A. Section 23 20 00 Heating, Ventilating and Air Conditioning Systems
- B. Section 23 07 00 Heating, Ventilating and Air Conditioning Insulation
- C. Section 23 09 00 Heating, Ventilating and Air Conditioning Instrumentation and Control

1.03 DRAWINGS AND SPECIFICATIONS

- A. Examine and become familiar with all project drawings and sections of the specifications, and coordinate the work accordingly. Make reasonable modifications in the layout and installation as needed to prevent conflict with work of other trades and for proper execution of the work, without additional cost.
- B. The drawings indicate approximate locations of equipment, ductwork, piping, etc., however, prior to ordering any equipment or materials, or performing any work, all dimensions, locations, and clearances shall be verified by the Contractor, based on actual field conditions, following the necessary coordination with other trades.
- C. The substitutions of equipment may not be the same as that which was used as a basis for design. The term substitutions only refers to items listed in our specification that are not used as the basis of design on our drawings. Provide all necessary revisions to the installation, or work of all other trades to accommodate the substituted equipment, maintaining comparable clearances and provisions for maintenance shall be provided, with all related costs, by the Contractor. Submit substituted working drawings and submittals that have been coordinated with all other associated trades, showing the proposed installation.
- D. It is the intention of the specifications and drawings to call for finished work, tested and ready for operation.

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- E. Where any device or part of equipment is herein referred to in the singular number, such reference shall be deemed to apply to as many such devices as are required to complete the installation or as shown.

1.04 SUBMITTALS - SHOP DRAWINGS/PRODUCT DATA/MATERIAL CERTIFICATIONS

- A. Submittals shall include six copies of all shop drawings, product data and material certifications for the project. These submittals shall be sent to the GUHSD Representative.
- B. GUHSD Representative will review the shop drawings, product data and material certifications for the project. Do not fabricate pipe, duct or order any equipment without shop drawings and product data being approved. All pipe systems, duct systems, equipment and other accessories require submittal review.
- C. Shop drawings, product data and material certifications shall be complete in every respect so that a thorough review and evaluation can be performed. All required shop drawings, product data and material certifications shall be submitted at one time. Incomplete submittals, those without shop drawings, those that are not prepared properly, or submittals with less than the required number of copies, shall be returned for resubmittal.
- D. It is intended that only a one-time review of all shop drawings and submittals will be performed, and any additional checking, which is required due to improper preparation by the Contractor, will be billed as an extra cost to the Contractor.
- E. All shop drawings, product data and samples submitted by the Contractor shall illustrate details of work, equipment, materials, products, systems, designs or workmanship that the Contractor intends to use in order to comply with the design concept established in the contract documents. The review of these submittals is only for the limited purpose of checking the same for conformity with the design concept of the work as established in the contract documents. The review is not intended to be for the purpose of determining the accuracy of other matters that may be contained in such submittals, including but not limited to such matters as dimensions, quantities and performance of equipment. Contractor shall furnish construction means, methods, techniques, sequences, procedures or safety precautions, the correctness of which as set forth in the contract documents or submittal shall be the sole responsibility of the Contractor.
- F. Only equipment, material and components of those manufacturers indicated in this specification are acceptable. Products that have not been reviewed and accepted by the GUHSD Representative before the bidding period will not be accepted.
- G. To be considered as acceptable confirm that the alternate manufacturers' equipment or fixture is comparable with regard to such features as noise level, power requirements, metal gauges, vibration attenuation, finish, appearance, certification of recognized testing agencies and standard bureaus, allowable working pressures, physical size and arrangement. The Contractor shall also consider the effect of installation in the available space, factory-applied insulation, electrical devices, controls, access to internal parts, operating efficiencies, and all other features and capacities specified herein. The GUHSD Representative shall be judge of the ability of any equipment, fixture or material to meet the requirements of this specification and the burden of proof shall be the responsibility of the Contractor.

- H. Format: Each type of equipment, fixture or material shall be submitted in a separate section of the submittal package and each such section shall have:
- I. A cover sheet identifying the equipment or fixture by the numbers or letter identical to those listed on the Drawings and/or Specifications, the manufacturer, the model number and size, and the technical data required for each piece of equipment or fixture. Materials shall be identified by system type.
- J. Dimensional drawings (including optional accessories appropriate to this project).
- K. Electrical data tables showing voltage, phase, horsepower (or kW), full load (or rated load) amperes and maximum fuse protection for each piece of equipment.
- L. Capacity data tables (copies of catalog capacity tables) including fan curves for air moving devices.
- M. Each submittal shall specifically reply to every item of equipment, fixture or material specified or scheduled. All information shall be listed on the submittal cover sheet and shall be marked in the submitted manufacturer's literature. All exceptions to the individual specifications shall be listed separately on the submittal cover sheet and shall be noted on submittal "cut sheet".
- N. Shop drawings are required for the heating, ventilating and air conditioning systems. Submit one set of original drawings suitable for reproducing clear copies and provide six copies of drawings. The shop drawings will be reviewed. Contractors shall reproduce copies for their use. Shop drawings, equipment, fixture and material submittals shall be delivered at the same time.

1.05 INVESTIGATION OF CONDITIONS

- A. Where new underground trenching is required on sites or in any area where existing underground utilities exist, the contractor shall provide an independent professional utility locating service to locate exact vertical and horizontal locations of all existing utilities. Where existing utilities are found the contractor shall hand dig those areas to avoid disruption, the contractor shall be responsible for immediate repairs to existing underground utilities damage during construction. The contractor shall repair all existing asphalt, concrete and landscape surfaces damaged or removed during construction to match their original conditions. Where trenching extends through public streets or roadways, the contractor shall notify underground service alert in addition it the independent locating service before start of construction to determine location of existing utilities.
- B. {This project is a remodel of an existing site with existing buildings. There are existing conditions and utilities that must be accounted for and an examination of the building and site is mandatory.}
- C. ~~{This project is a remodel of existing buildings. There are existing conditions that must be accounted for and an examination of the building and site is mandatory.}~~
- D. ~~{This project is on an existing site with existing utilities and an examination of the site is mandatory.}~~

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- E.C.** Examine the existing conditions bearing on labor, transportation, handling and storage of materials, etc. Visit the site to understand the nature and scope of all work to be performed. The submission of a bid will be taken as evidence that such an examination has been made and all conditions have been considered.

1.06 EXISTING INSTALLATION AND CONFLICTS

- A.** Existing active services, water, sewer, electric, other piping systems, when encountered, shall be protected against damage due to construction work. Do not disturb operation of active services that are to remain.
- B.** If existing active services are encountered which require relocation, make request to the GUHSD Representative for determination of procedures. Where existing services are to be abandoned, they shall properly terminate in conformance with requirements of the GUHSD Representative.
- C.** If work makes temporary shut-downs of services unavoidable, consult with GUHSD Representative as to dates, procedures and estimated duration of shut-down period in advance of the date work is to be performed.
- D.** Work shall be performed to assure that the existing operating services will be shutdown only during the time allowed and required to construct necessary connections. If a system cannot be shutdown, temporary bypass jumpers shall be installed until connections are complete.
- E.** Be responsible for all costs incurred by the above shut-downs, including bypass or jumper installations for work performed under Division 23.
- F.** If existing active utility services are encountered which require relocation, make request to GUHSD Representative or other proper authorities for determination of procedures. Where existing services are to be abandoned, they shall properly terminated and capped.

1.07 ORGANIZATIONS

- A.** Below is a list of organizations that may be identified throughout the specifications by the letters in parenthesis only.
1. American Society of Heating, Refrigerating, Air Conditioning Engineers (ASHRAE)
 2. American Society of Mechanical Engineers (ASME)
 3. American Society for Testing and Materials (ASTM)
 4. Factory Mutual Laboratories (FM)
 5. National Electrical Manufacturer's Association (NEMA)
 6. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
 7. Underwriters' Laboratories, Inc. (UL)
 8. American National Standards Institute (ANSI)
 9. Air Conditioning and Refrigeration Institute (ARI)

1.08 DEFINITIONS

- A. Furnish: To purchase and supply equipment, materials or components and deliver to the jobsite.
- B. Install: To place, fix in position, secure, anchor, etc., including necessary appurtenances and labor so the equipment or material of the installation will function as specified and intended.
- C. Provide: To furnish and install.
- D. Piping: Includes, in addition to pipe, all fittings, flanges, valves, hangers, and other accessories related to such piping.
- E. Concealed: Means hidden from sight in chases, furred spaces, shafts, hung ceilings, or embedded in construction.
- F. Exposed: Means not installed underground or "concealed" as defined above. Tunnels, trenches, attic spaces and crawl spaces are considered exposed.
- G. Accepted/Acceptable: Items, that in the opinion of the GUHSD Representative, are acceptable alternates for the item specified.
- H. CalGreen: California Green Building Standards, CCR Title 24 Part 11, Chapter 5

1.09 CODE, PERMITS AND FEES

- A. By submitting a Bid, Contractor is deemed to represent himself as competent to accomplish the work of this Division in conformance with applicable Codes. The Contract Documents may require installations which exceed Code requirements, but are not intended to allow installations which are below minimum Code requirements. In case of conflict where the Contract Documents are below the minimum requirements of applicable Codes, the Codes shall take precedence. Should such conflicts appear, cease work on the parts of the contract affected and immediately notify the Architect in writing. It shall be the Contractor's responsibility to correct, at no cost to the District, any work he executes in violation of Code requirements.
 - 1. Applicable Codes: (Current adopted editions except as noted):
 - a. **California Building Code**
 - b. **California Green Building Standards**
 - c. **California Mechanical Code**
 - d. **California Fire Code**
 - e. **California Plumbing Code**
 - f. **California Electrical Code**
 - g. **Fire Marshal Regulations**
 - h. **Regulations of all other authorities having jurisdiction.**
 - 2. Where conflict or variation exists amongst Codes, the most stringent shall govern.
- B. The drawings and specifications take precedence when they are more stringent than codes, ordinances, standards and statutes. Codes, ordinances, standards and statutes take precedence where they are more stringent than the drawings and specifications.

- C. Secure and pay for permits, tests, Certifications of Inspection, and all other costs incidental to the work.

1.10 GENERAL COORDINATION OF WORK AND WORKING PROCEDURES

- A. All equipment and materials shall be covered or otherwise protected from the weather, theft, etc., both when stored on the site and after installation, until final acceptance by the GUHSD Representative. All open ends of installed piping and ductwork for partially completed systems shall temporarily be plugged and capped.
- B. All materials of construction shall be new and shall bear the manufacturer's labels and trademarks.
- C. The specifications indicate general requirements for the installation of all equipment and materials however, follow the specific instructions and directions furnished by the equipment or fixture manufacturer.
- D. All equipment shall be installed with full consideration of future maintenance. Equipment that is installed such that it cannot be readily serviced shall be removed and installed correctly as directed to facilitate servicing.
- E. Unions, valves, dampers, and other components that may require lubrication or maintenance shall be located to provide sufficient accessibility. When necessary, provide access doors as hereinafter specified at all locations where these items are concealed within walls, chases, or above ceilings which do not have an inherent accessibility feature.
- F. Prior to testing and balancing of air systems, clean the interior of all duct systems and air handling equipment.
- G. Surfaces to be painted shall be wiped, scraped, or wire-brushed as necessary to a clean, smooth painting surface, free from oil, rust and dirt. All material and equipment that is furnished with a factory prime coat of paint, which is damaged in transit, during storage, or from exposure to weather, shall be prime painted.
- H. Contractor shall be responsible for costs related to damage caused by leaks in piping systems, or any other malfunction of the equipment, materials, systems, or work, including repairs, replacements, etc.
- I. Contractor shall provide information to other Contractors relative to all required duct or pipe penetrations in walls, floors, roofs etc. The Contractor shall provide information to other Contractors relative to roof curbs. Structural work shall not be altered in any way.
- J. All necessary cutting and patching of roofs, walls, floors, ceilings, etc., as required for the proper installation of the work under this section, shall be performed, and in a neat and workmanlike manner. No joists, beams, girders, columns, or other structural member shall be cut.
- K. Contractor to provide all scaffolding, rigging, hoisting, and services necessary for erection and delivery into the premises for all equipment and materials, and remove same from premises when no longer required.

- L. Carefully lay out work on the premises and make proper provision for the other work. The exact location of each item shall be determined by reference to the drawings, by measurements at the building, and in cooperation with other contractors. Be responsible for accurately locating all openings for ducts, pipes, etc., and all access doors required.
- M. Schedule and coordinate work so as to execute expeditiously the contract and to avoid unnecessary delays.
- N. Examine fully the specifications and drawings for other trades, to become familiar with all conditions affecting work, and consult and cooperate with other trades for determining space requirements and adequate clearances with respect to other equipment in the building. GUHSD Representative shall determine space priority of the trades in the event of interference between ductwork, piping, conduit, and equipment of various trades.
- O. If the work is installed without coordinating with other trades, and the installation interferes with their installation, the contractor shall make any changes necessary in this work to correct conditions without extra charge.

1.11 ELECTRIC

- A. Coordinate the voltage and phase characteristics of each HVAC unit and motor with the electrical shop drawings.
- B. Do not exceed electrical requirements of HVAC equipment without fully disclosing this information to the GUHSD Representative.
- C. Motors shall be suitable for non-overloading operations, regardless of operating conditions, and shall be capable of continuous operation at full nameplate rating. Motor speed shall be a maximum of 1750 RPM, unless otherwise noted.
- D. Motors for belt drive shall have adjustable bases with set screw to maintain belt tension. Motor horsepower indicated on the drawing equipment schedules are the minimum size acceptable.
- E. NEMA Standards shall be taken as minimum requirements for motor design and performance. Motors shall be suitable for load, duty, voltage, frequency, hazard and for service and location intended. Motors shall be high efficiency type.
- F. Motors shall have name plate giving manufacturers name, shop number, HP, RPM and current characteristics. Motors for outdoor service shall be TEFC.

1.12 MOTOR STARTERS

- A. Provide motor starters for all HVAC and other mechanical equipment. Provide correct size and voltage characteristics per electrical requirements. Motor starters shall be provided by Division 23 and coordinated with electrical drawings.

1.13 EQUIPMENT SUPPORTING PROVISIONS

- A. Contractor shall confirm locations with GUHSD Representative before installation of hangers, curbs, platforms, equipment frames, etc. Contractor shall coordinate all related work with other trades.

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- B. Equipment schedules on the drawings indicate a particular manufacturer for all equipment and the architectural and structural drawings indicate supports and other design considerations which were based on the use of this equipment.
- C. Contractor shall confirm all support dimensions and locations based on the actual equipment to be installed and shall coordinate all related work with other Contractors.
- D. Mechanical equipment drawing schedules indicate a particular manufacturer for equipment and the structural drawings indicate supports and other design considerations that were based on the use of this equipment. If the Contractor chooses to furnish items other than those indicated, they shall assume all responsibilities and additional costs for the furnishing and installation of the proper steel framing.
- E. Where supports, foundations, stands, suspended platforms for equipment are indicated on drawings or specified in specifications design and construct supporting structures of strength to safely withstand stresses to which they may be subject and to distribute properly the load and impact over building areas. Conform to applicable technical societies' standards, also to codes and regulations of agencies having jurisdiction. Contractor shall provide sufficient supports as required. These supports are for foundations, supporting stands, platforms and they shall be connected to the building structural members. All equipment shall be bolted to supports, foundations, stands and platforms. Design of the supports, foundations, supporting stands and platforms must be approved by a California State Licensed Structural Engineer.

1.14 MACHINERY DRIVES AND ACCESSORIES

- A. Belt drives: Use approved V-belts of the proper number and size, complete with the necessary grooved sheaves and other requisite accessories. Belts for motors shall be capable of not less than 20% in excess of actual motor size used on the job.
- B. Belt guards: All belt drivers shall be protected with belt guards, enclosing both the driving and the driven pulleys, securely fastened in place and provided with removable covers at each shaft center. Belt guards shall comply with all code requirements.
- C. Sheaves: All motor sheaves shall be of the variable pitch type unless otherwise noted. Pitch of variable pitch sheaves shall be selected at approximately 50% of the variable pitch range.
- D. Provide guards for all exposed couplings on rotating equipment.

1.15 LUBRICATION

- A. Lubricate as required all motors, bearings, fans, etc., before operation of any equipment.
- B. Provide a final lubrication to all equipment requiring it before turning over the system to the Owner.

1.16 PIPE SLEEVES

- A. Sleeves shall be schedule 40 galvanized steel pipe.

- B. Pipe motion due to expansion and contraction will occur, make sleeves of sufficient diameter to permit free movement of pipe. Where pipes are insulated, make sleeves of sufficient diameter to pass pipe insulation. Check floor and wall construction and finishes to determine proper length of sleeves for various locations. Terminate sleeves flush with walls, partitions and ceiling. Extend sleeves 1/4" above finish floor, except in equipment rooms and other areas where water may accumulate on floor, extend to 1-1/2".
- C. Set sleeves in ample time to permit pouring of concrete or to allow progression of other work as scheduled. Fasten sleeves securely so that they will not become displaced when concrete is poured or when other construction around them. For sleeves in fire walls, pack space between sleeve and pipe with approved non-combustible material and as otherwise required by local code; for floors where water is to be kept out, fill with graphite packing and caulking compound.
- D. Sleeves in underground walls shall be 1-1/2" larger than outside diameter of pipe. The space between sleeve and pipe shall be sealed with 1" long wool and 1/2" water tight flex caulking on both sides of the wall. The seal shall be guaranteed watertight.

1.17 ESCUTCHEONS

- A. Provide 20 gauge escutcheons at all pipe penetrations in walls, ceilings and floors. Escutcheons shall be one piece or hinged two piece type with positive latch or setscrew, and shall be polished chrome plated in finished rooms, and polished brass in other areas. Escutcheons shall have tempered springs or other means to insure positive attachment to pipe. The escutcheon opening shall be of sufficient diameter to fit around the insulation of insulated pipes, and the outside diameter of the escutcheon shall be of sufficient size to conceal the pipe sleeves.

1.18 EXPANSION AND FLEXIBILITY

- A. Install all work with regard for expansion and contraction to prevent damage to the piping, ductwork, equipment and the building and its contents. Provide piping offsets, expansion loops, approved type expansion joints, anchors or other means to control pipe movement and to minimize pipe forces.

1.19 ACCESS PANELS/DOORS

- A. Provide access panels/doors. Refer to other Division 23 Sections for further reference. Provide access panels/doors with have same fire rating as ceiling, wall or duct in which they are installed, and shall be of sufficient size to provide the required accessibility.
- B. Provide access panels/doors where necessary to provide access to concealed volume dampers, fire dampers, water hammer arrestors, trap primers, cleanouts, shut off valves, control valves etc.
- C. Access doors:
 - 1. Material and Manufacturer: Stainless Steel Series is 16 gage #304 stainless steel door and frame. Provide cylinder key lock. Equal to MIFAB UA-SS. All MIFAB cylinder locks are keyed alike.
 - 2. Sizes shall be 14" X 14" at easily accessible valves, water hammer arrestors, trap primers, cleanouts etc; 18" X 18" where partial body access is required; 24" X 24" where entire body access is necessary.
 - 3. Confer with other contractors with respect to access panel locations and shall wherever practicable group mechanical and electrical equipment in such a way as to be accessible from a single panel and reduce number of doors required.

1.20 TRENCHING, EXCAVATING AND BACKFILLING

- ~~A. Perform all trenching, excavation and backfilling necessary for the installation of underground piping [sewers, natural gas, water piping, receivers, interceptors, tanks, and other piping] as required.~~
- ~~B. Obtain the services of an "Underground Locator Service". This Underground Locator Service shall identify all utilities or structures that may be in the path of the underground piping.~~
- ~~C. Concrete and asphalt shall be removed by first providing saw cut lines. These new saw cut lines shall be at existing joints. For concrete cut and removal, a whole section of concrete from joint line to joint line shall be cut and removed.~~
- ~~D. Dig trenches to required grade and depth with only sufficient earth material removed to provide working space. Trenches dug below the required depth shall be refilled to proper depth with sand.~~
- ~~E. Restore to original condition all paved surfaces, including concrete, asphalt, landscaping and any other work which was cut or disturbed through the performance of work under this contract. New concrete and asphalt shall match the existing thickness, density, quality, material characteristics and surface appearance.~~

- ~~F. All testing and inspections shall be complete, and approvals obtained, before backfilling is performed.~~
- ~~G. Backfill material around pipe shall consist of sand. Provide a minimum of 4 inches of sand all round piping systems. The remainder of the backfill materials shall be free of rocks, debris, and other foreign materials and shall consist of earthy sand.~~
- ~~H. Provide tracer wire around site non metallic water piping systems. Provide tracer wire around site non metallic natural gas piping systems. Tracer wire shall be 14 gauge copper wire with plastic covering. Tracer wire shall extend 6 inches above grade at the ends of the piping systems. Provide warning tape a minimum of 18" above pipe.~~
- ~~I. Water puddle and tamp backfill material in layers of approximately 6" up to finish grade, and as otherwise required so that no settling will occur.~~
- ~~J. All excess excavated materials shall be disposed of.~~

4.241.20 CORROSION PROTECTION

- A. All metallic piping underground shall wrap with 2 layers of 10-mil plastic tape.
- B. No pressurized water lines will be permitted under building the concrete slab.
- C. All water valves, regulators and other devices shall installed in pre-cast concrete yard boxes with galvanized steel lids. All water valves, water pressure regulators and other devices will not be installed in any soil.
- D. Any piping passing through concrete floors, walls or roofs shall be sleeved and wrapped 3 times with plastic foam wrap. Provide epoxy joint sealer, non-shrink, waterproof caulking around all piping risers coming up through concrete floors & sidewalks. If the floors, walls or roofs are existing then core these areas. Provide foam sealant and epoxy joint sealer (non-shrink) waterproof caulking around the space between the pipe and the floors, walls or roofs.

4.221.21 FIRE STOPPING

- A. Provide fire stopping at all rated floors, walls or roofs. Use UL listed materials and methods for sealing these areas.

4.231.22 IDENTIFICATION OF EQUIPMENT

- A. Each item of equipment shall be permanently labeled with a plastic nameplate of sufficient size to clearly indicate the identification designation appearing on the construction drawings. Letters shall be a minimum of 2 inches high.

4.241.23 GENERAL TESTING REQUIREMENTS FOR EQUIPMENT

- A. The following requirements are supplementary to tests specified for individual equipment or systems in other Division 23 sections:
 - 1. Furnish labor, materials, instruments, electric power, etc., and bear all costs in connection with these tests.

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2. Give a minimum of 72 working hour notification to the GUHSD Representative when tests will be conducted. Coordinate test with other trades.
 3. After the work has been completed, subject all systems to acceptance tests under normal operating conditions for periods of 5 working days to show compliance with Contract requirements. Submit to the GUHSD Representative a written certificate that all tests have been performed in accordance with the specification requirements.
 4. All equipment, fans, and motors shall run at their required speed without showing undue vibration, objectionable noise, or sparking for a period of 5 working days.
 5. Balance individual units and adjust dampers, registers, diffusers, etc., so that they deliver air quantities indicated for each outlet, and inlet, or as required.
 6. Submit to the GUHSD Representative a written certificate that all tests have been performed in accordance with the specification requirements.
- B. Adjustments, repairs, and re-tests:
1. Make adjustments, repairs and alterations, as required to meet specified test results.
 2. Correct defects disclosed by tests or inspections, and replace defective parts when directed.
 3. In replacing defective parts, use only new materials, and in the case of pipe, replace with same length as defective piece.
 4. Repeat tests after defects have been corrected and parts replaced, as directed and until pronounced satisfactory.
 5. Bear the cost of repairs, and restoration of the work by other Contractors that have been damaged by the tests.

4.251.24 RECORD DRAWINGS

- A. Maintain at the site, a set of record drawings, upon which shall be clearly indicated (by shading, coloring, or some other acceptable method) the day by day extent of the work installed. Indicate all changes to the original design at the end of each day.
- B. At the completion of the construction phase, furnish to the GUHSD Representative all necessary drawings showing work which was not installed as shown in the contract drawings. A minimum of one set of originals and three copied sets shall be furnished. Indicate all pertinent information, i.e., valve locations, pipe and duct routing (dimensionally located), etc. All underground piping shall be located on the record drawings by two or more dimensions. All elevations (inverts) shall be shown with the point of elevation change clearly located. All valves shall be numbered and lettered to correspond with the numbers and letters on the site.

4.261.25 EMERGENCY REPAIRS

- A. The Owner reserves the right to make emergency repairs as required to keep systems in operation without relieving the Contractor of his responsibilities during the post/partial beneficial occupancy.

~~4.27~~1.26 OPERATION BY OWNER

- A. The Owner may require operation of parts or all of the respective installations prior to final acceptance. The Owner shall pay for cost of utilities for such operation. Operation of the installation shall not be construed as acceptance of the work.

~~4.28~~1.27 INSTRUCTION MANUAL

- A. Prior to completion of installation and final inspection of work, furnish to the GUHSD Representative a minimum of three copies of complete instruction manual, bound in booklet form and indexed for each respective trade.
- B. Manual shall contain the following items:
 - 1. List of all equipment with manufacturer's name, model number and local representative, service facilities, and normal channel of supply for each item.
 - 2. Manufacturer's literature describing each item of equipment with detailed parts list.
 - 3. Detailed step-by-step instructions for starting, summer operation, winter operation, and shutdown of each system.
 - 4. Detailed maintenance instructions for each system and piece of equipment.
 - 5. Copy of each automatic control diagram with respective sequence of operations.
 - 6. Individual equipment guarantees.
 - 7. Certificates of inspections.
 - 8. Copies of as-built construction and related shop-drawings.
 - 9. All written material contained in manual shall be typewritten.

~~4.29~~1.28 INSTRUCTION OF OWNER'S PERSONNEL

- A. Prior to acceptance of work and during time designated by the GUHSD Representative provide necessary qualified personnel to operate each system for a minimum period of two consecutive, full working days. During the two working days provide training for each system.
- B. During operating period, fully instruct GUHSD Facility Representatives in complete operations, adjustment, and maintenance of each respective installation.

~~4.30~~1.29 GUARANTEES AND WARRANTIES

- A. All work shall be guaranteed to be free from defects in material and workmanship for a period of one year from the date of final acceptance of the work, or a longer period if stipulated under specific headings. Replace at no additional cost any material or equipment developing defects and also pay for any damage caused by such defects, or the correction of defects.

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- B. Use warrantee terms for specific items of equipment, relative to the work guarantee requirements of this specification.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 23 05 00

TESTING, ADJUSTING, AND BALANCING FOR HVAC SYSTEMS

Note to Engineers: —

All Equipment must be shown on the drawings in an equipment schedule. Refer to Division 23 Specifications and Material Standards.

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Testing, adjusting, and balancing of air systems.

1.02 SUBMITTALS

- A. Draft Reports: Submit for review prior to final acceptance of Project.
- B. Test Reports: Submit prior to final acceptance of Project and for inclusion in operating and maintenance manuals. Assemble in soft cover, letter size, 3-ring binder, with table of contents page and tabs, and cover identification. Include reduced scale drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

1.03 BALANCING AND ADJUSTING

- A. This section covers testing and balancing of environmental systems including air distribution systems, and the equipment and apparatus connected thereto. The testing and balancing of all environmental systems shall be the responsibility of one Testing, Balancing and Adjusting (TBA) firm. The minimal standards to be met are those set forth in Chapter 40 in the latest edition of the ASHRAE Systems Handbook.
- B. The balancing, testing and adjustments of the complete mechanical systems shall be the direct responsibility of the Contractor and Contractor shall engage the services of an independent firm specializing in this work. The definition of independent shall mean the firm is not associated with any contracting or manufacturing firm and derives its income solely from testing, adjusting and balancing mechanical systems. Acceptable testing, adjusting and balancing firms are those which are AABC certified. NEBB firms must also be AABC certified for consideration.
- C. The balancing work shall be performed by the same firm having total professional responsibility for the final testing, adjusting, and balancing of the entire system.
- D. Testing and balancing work shall be directly supervised and the results confirmed by a Registered Professional Mechanical Engineer who shall represent the TBA firm in progress meetings as requested, and shall be available for interpreting all material found in the balance report.
- E. The balancing firm shall provide all tools, equipment and instruments required and shall take all readings, and make all necessary adjustments.

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- F. After all adjustments are made, prepare a detailed written report and submit for review. Report shall bear the Registered Professional Mechanical Engineer's Stamp of the person supervising the work. Final acceptance of this project will not be made until a satisfactory report is received.
- G. Verify the following conditions before proceeding with work:
 - 1. Conduct site observations during construction to determine the location of required balancing devices and confirm that they are properly located and installed. Submit a written report of these observations to the Architect.
 - 2. Installation of the designated system is complete and in full operation.
 - 3. Outside temperature conditions, occupant loads, lighting loads, special equipment requiring extra sensible or ventilation requirements, and solar conditions are within a reasonable range relative to design conditions or provide for acceptable simulation of loads and conditions that will result in a properly balanced system.
- H. All thermal overload protection shall be observed and noted on the data sheets. If the starter equipment is furnished and installed by the Contractor and thermal overload protection is incorrect, such information shall be tabulated, including required size thermal overloads, and included in the report. If thermal overload protection is incorrect, it shall be the responsibility of the Contractor to see that proper overload protection is installed.
- I. Measure and set any special conditions such as minimum outside air quantities; check and adjust outside and return air intakes so that the system will deliver substantially the same volume on either; make tests and record data as required in the "Balancing Report" section. All balancing devices such as dampers and valves shall be clearly marked as to the final balanced position. Plug all test holes, replace access doors and belt guards.
- J. Provide temperature recorders for spaces as necessary to verify acceptable space temperature conditions.
- K. Upon request of the GUHSD Representative a representative of the balancing firm performing the work shall demonstrate fluid flow quantities shown in the report by re-measuring outlets or terminals selected at random by the GUHSD Representative to verify accuracy of settings.
- L. Requirements for balancing air systems are as follows:
 - 1. Before any adjustments are made; the major items of equipment shall have been checked to assure all bearings have proper lubrication; all belt drives shall have been adjusted for proper alignment and tension; and the systems shall have been checked for such items as dirty filters, duct leakage, filter leakage, damper leakage, equipment vibrations, correct damper operations, etc.

2. Adjust fan systems, major duct sections, registers, diffusers, etc., to deliver design air quantities within plus or minus 5%. If Individual air outlets serve more than one space, they may have a tolerance of 10% from the average. Design CFM is based on filters being approximately 50% loaded. Pressure drop across filters during balancing shall be simulated to that condition. After balancing is completed, verify that motor is not overloaded with the filters clean.
 3. Check and adjust CFM settings on diffusers and grilles.
 4. Check and adjust minimum and maximum CFM settings on VAV boxes to design values regardless of factory presetting of these devices.
 5. Adjust distribution systems to obtain uniform space temperatures free from objectionable drafts and noise within the capabilities of the system.
 6. Exchange and pay for sheaves and/or belts as required to adjust the rpm of fans to handle specified air quantity.
- M. Requirements for balancing hydronic systems are as follows:
1. Before any adjustments are made systems shall have been pressure tested as specified elsewhere. Strainers shall have been cleaned; temperature control valve operation checked, pump rotation checked, pressure reducing valves adjusted, etc.
 2. Using system flow meters and contact pyrometer where necessary, adjust the quantity of fluid handled by each pump and supplied to each coil, heat exchanger, etc., to meet design requirements.
- N. Provide four copies of a "Balancing Report" to the GUHSD Representative. The Mechanical Engineer shall review this report. This report shall contain a general information sheet listing instruments used, method of balancing, altitude correction calculations, manufacturer's grille, register, and diffuser data. Report shall contain the following additional data.
1. Equipment data sheets listing make, size, serial number, rating, operating data, etc., of all mechanical equipment including fans, motors, starters, and drives. Operating data shall include rotational speed, inlet and outlet pressures, pressure drop across filters, coils and other system components, and measured motor current and voltage.
 2. Balancing data sheets listing the required and actual CFM of all supply, return, and exhaust outlets or inlets, and totals summarized by systems.
 3. A reduced set of contract drawings with outlets marked thereon for easy identification of the designation used in the data sheets.
 4. Listing of any abnormal or notable conditions not covered in the above.
- O. Even though it is the responsibility of the balancing firm to check the physical operation of each operating piece of equipment, the control contractor must assure the balancing firm that all controls are accurately calibrated and must cooperate with him during the balancing work period.

- P. The agency performing the system balance and performance test, shall personally verify that all system control functions and interlocking do in fact provide the desired results as stated. The agency shall provide a written statement within the air balance report verifying this fact.

**PART 2 – PRODUCTS
(NOT APPLICABLE)**

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Before starting work, verify systems are complete and operable.
- B. Report defects, deficiencies, or abnormal conditions in mechanical systems preventing system balance.
- C. Beginning of work means acceptance of existing conditions.

3.02 INSTALLATION TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.
- B. Air Outlets and Inlets: Adjust to within plus or minus 10 percent of design.

3.03 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to deliver design supply, return, and exhaust air quantities within previously stated tolerances.
- B. Make air quantity measurements in ducts by traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Use volume control devices to regulate air quantities only to extent those adjustments do not create objectionable air motion or sound levels. Change volume using dampers mounted in ducts.
- E. Vary total system air quantities by adjustment of fan speeds. Provide drive changes to accomplish system air flow. Vary branch air quantities by damper regulation.
- F. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across fan. Allow for pressure drop equivalent to 50 percent loading of filters.
- G. Adjust automatic outside air, return air, and exhaust air dampers for design conditions.
- H. Measure temperature conditions across outside air, return air, and exhaust air dampers to check leakage.
- I. At modulating damper locations, take measurements and balance at extreme conditions.

3.04 FIELD QUALITY CONTROL

- A. Verify recorded data represents actually measured or observed conditions.
- B. Permanently mark settings of valves, dampers, and other adjustment devices. Set and lock memory stops.

END OF SECTION

SECTION 23 07 00

HEATING VENTILATING AND AIR CONDITIONING INSULATION

Note to Engineers:—

All Equipment must be shown on the drawings in an equipment schedule. Refer to Division 23 Specifications and Material Standards.

PART 1 - GENERAL

1.01 SUMMARY

- A. Provide labor, equipment and materials, and perform all operations necessary for the installation of insulation as indicated. This section includes thermal insulation for piping and equipment, and thermal and acoustic insulation applied to ductwork and air handling devices.
- B. Provide complete Insulation Submittals and Shop drawings. Refer to Section Heating Ventilating and Air Conditioning 23 01 00 paragraph 1.4 Submittals - Shop Drawings/Product Data/Material Certifications.

1.02 RELATED SECTIONS

- A. Section 23 01 00 General Provisions for Heating, Ventilating and Air Conditioning
- B. Section 23 20 00 Heating, Ventilating and Air Conditioning Systems
- C. Section 23 09 00 Heating, Ventilating and Air Conditioning Instrumentation and Control

1.03 FIRE HAZARD CLASSIFICATION

- A. Insulation shall have a composite (insulation, jacket or facing, and adhesive to secure jacket or facing) fire hazard rating as tested by ASTM E84, NFPA 255, or UL 723 not to exceed 25 flame spread and 50 smoke developed. Materials labeled accordingly.
- B. Insulation shall conform to current California Mechanical Code.

1.04 QUALITY ASSURANCE

- A. Furnish insulation systems to the project site bearing the manufacturer's label.
- B. Appearance shall be of equal importance with its mechanical correctness and efficiency.

1.05 PROTECTION

- A. Protect insulation against dirt, water, chemical, or mechanical damage before, during and after installation. Any such insulation or covering damaged prior to final acceptance of the work shall be satisfactorily repaired or replaced.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

1.07 SUBMITTALS

- A. Comply with specification Section 23 01 00 General Provisions for Heating, Ventilating and Air Conditioning.
- B. Required Submittals
 - 1. Piping insulation, jackets and accessories.
 - 2. Ductwork insulation, jackets, and lining.
 - 3. Equipment insulation and covering.
 - 4. For each product being submitted, provide product description, list of materials, thickness, location of use and manufacturer's installation instructions.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Acceptable manufacturers for insulation are Johns Manville Corporation, Owens-Corning and Knauf.
- B. Acceptable manufacturers in addition to insulation manufacturers for adhesives, sealants and coatings are Foster Products.
- C. Duct tape is not an approved sealer tape and shall not be used on this project.

2.02 PIPING SYSTEM INSULATION

- A. Insulation Type
- B. Glass Fiber: Johns Manville Micro-Lok meeting ASTM C547 or equal; rigid molded, noncombustible, Class 1 not to exceed 25 flame spread and 50 smoke developed.
 - 1. 'K' ('KSI') Value: 0.23 at 75 degrees F (0.033 at 24 degrees C).
 - 2. Maximum Service Temperature: 850 degrees F (454 degrees C).
 - 3. Vapor Retarder Jacket: AP-T PLUS White kraft paper reinforced with glass fiber yarn and bonded to aluminum foil, secure with self sealing longitudinal laps and butt strips or AP Jacket with outward clinch expanding staples or vapor barrier mastic as needed. All insulation and jacket material shall be plenum rated.
 - 4. Provide 18 gauge galvanized metal insulation shields at pipe hangers. Insulation shields shall provide an expanded surface area to carrier the weight of the piping without distorting or damage to insulation.
- C. Elastomeric Foam: K-Flek Insul-Tube meeting ASTM C534 or equal; flexible, cellular elastomeric, molded or sheet, Class 1 not to exceed 25 flame spread and 50 smoke developed:
 - 1. 'K' ('KSI') Value: 0.28 at 75 degrees F (0.04 at 24 degrees C).

2. Maximum Service Temperature of 220 degrees F (104 degrees C).
 3. Maximum Flame Spread: 25.
 4. Maximum Smoke Developed: 50.
 5. Connection: Waterproof vapor retarder adhesive, as needed; K-Flex 373 Contact Adhesive.
 6. UV-Protection: Outdoor protective coating; K-Flex 374 Protective Coating.
 7. Provide 18 gauge galvanized metal insulation shields at pipe hangers. Insulation shields shall provide an expanded surface area to carrier the weight of the piping without distorting or damage to insulation.
- D. Cellular Glass: ASTM C522; 'k' value of 0.35 at 75 degrees F ('KSI' value of 0.047 at 24 degrees C); 8.0 LB/CU FT (128 Kg/cu m) density, Class 1 not to exceed 25 flame spread and 50 smoke developed.
- E. Field Applied Jackets
1. Aluminum Jacket: 0.016 inch (0.045 mm) thick sheet, (smooth / embossed) finish, with longitudinal slip joints and 2 inch (50 mm) laps, die shaped fitting covers with factory attached protective liner.
 2. [PVC Plastic: Johns Manville Zeston® 2000. One piece molded type-fitting covers and jacketing material, gloss white. Connections: Tacks; Pressure sensitive color matching vinyl tape.]
 3. [Stainless Steel Jacket: Type 304 stainless steel, 0.010 inch (0.25mm), (smooth / corrugated) finish.]

2.03 DUCT WORK INSULATION

- A. Flexible Fiberglass Insulation Wrap Blanket: Johns Manville Microlite Type 100 meeting ASTM C1290 - 11 or equal, Type II, Class B-2; flexible blanket, Class 1 not to exceed 25 flame spread and 50 smoke developed. All flexible fiberglass insulation wrap blanket insulation shall have foil back jacket.
1. 'K' ('KSI') Value: 0.25 at 75 degrees F (0.040 at 24 degrees C) installed.
 2. Vapor Barrier Jacket: FSK, Aluminum foil reinforced with fiber glass yarn and laminated to fire-resistant kraft, secured with UL listed pressure sensitive tape and/or outward clinched expanded staples and vapor barrier mastic as needed. All insulation and jacket material shall be plenum rated.
- B. Rectangular Duct Liner: Johns Manville Linacoustic Mat Faced or Permacote meeting ASTM C1071 or equal; flexible blanket.
1. 'K' ('KSI') Value: ASTM C518, 0.25 at 75 degrees F (0.036 at 24 degrees C).
 2. Noise Reduction Coefficient: .65 or higher based on "Type A mounting". Comply with ASTM C423A Absorption Coefficients, ASTM E84, UL 723 and NFPA 255.
 3. Maximum Velocity on Mat or Coated Air Side: 4,000 ft/min.

4. Adhesive: UL listed waterproof type.
 5. Fasteners: Duct liner galvanized steel pins, welded or mechanically fastened.
 6. Absolute roughness of exposed surface not to exceed 0.0013 coated.
- C. Round Duct Liner: John Manville Spiracoustic Plus, meeting ASTM C1071 or equal; rigid.
1. 'K' ('KSI') Value: ASTM C518, 0.23 at 75 degrees F (.033 at 24 degrees C).
 2. Noise Reduction Coefficient of .70 as per ASTM C1071.
 3. Maximum Velocity: 4000 ft/min (20.3 mm/sec)
- D. Rectangular and round duct liner shall comply with the requirements of NFPA 90A and the "Application Standards for Duct Liners" of SMACNA. Duct liner shall be glass fiber insulation with exposed surface coated to prevent fiber erosion at air velocities up to 4000 fpm. Duct sizes for lined duct show the clear dimension inside the lining.

2.04 FIRE STOPPING INSULATION

- A. Fire stop insulation shall be ceramic fiber blanket equal to Morgan Thermal Ceramics "Cerablanket" or USG Therma-fiber 6 lb. density, Class 1 not to exceed 25 flame spread and 50 smoke developed.

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. Verify that ductwork has been pressure tested for leakage in accordance with SMACNA standards before applying insulation materials.
- B. Verify that all surfaces are clean, dry and free of foreign material. Apply insulation on clean, dry surfaces free of any foreign matter and only after tests and approvals required by the specifications have been completed.

3.02 GENERAL INSTALLATION

- A. Install materials in accordance with manufacturer's recommendations, building codes and industry standards.
- B. Continue insulation vapor barrier through penetrations except where prohibited by code.
- C. Insulation shall be installed by workmen regularly engaged in this kind of work in accordance with the manufacturer's recommendations.
- D. All exposed raw edges shall be finished with finishing cement.
- E. If staples are used, all must be coated with adhesive to maintain vapor barrier integrity. Thickness per ASHRAE Standards Table.

3.03 PIPING SYSTEM INSULATION INSTALLATION AND SCHEDULE

- A. Pipe insulation shall be continuous through walls and floor openings except where walls and floors are required to be fire stopped or required to have a fire resistance rating. Where this occurs, the open space remaining between the sleeve and pipe shall be filled with fire stop insulation.
- B. Insulation on piping indicated must be applied with a continuous, unbroken vapor seal. Supports, anchors, etc., that are secured directly to cold surfaces must be adequately insulated and vapor sealed to prevent condensation.
- C. Insulated pipes shall be insulated continuously through hangers. Rigid insulation inserts and metal shields are to be provided at all pipe hangers and supports. Pipe insulation shall abut the rigid insulation insert. Apply a wet coat of vapor barrier lap cement on all butt joints and seal the joints with 3" wide vapor barrier tape or band.
- D. Butt all joints firmly together and smoothly, secure all jacket laps and joint strips with lap adhesive.
- E. Locate insulation and cover seams in least visible locations.
- F. Neatly finish insulation at supports, protrusions, and interruptions.
- G. Provide insulated pipes conveying fluids below ambient temperature with vapor retardant jackets with self sealing laps. Insulate complete system.
- H. For insulated pipes conveying fluids above ambient temperature, secure jackets with self sealing lap or outward clinched, expanded staples. Bevel and seal ends of insulation at equipment, flanges, and unions.
- I. Provide shield between isolation inserts and hanger supports. Shields shall be minimum of 20 gauge galvanized metal. Fabricate of Manville Thermo-12 or other heavy density insulating material suitable for temperature. Insulation inserts shall not be less than the following lengths;

1 1/2" to 2 1/2" pipe size	10" long
3" to 6" pipe size	12" long
8" to 10" pipe size	16" long
12" and over	22" long
- J. For pipe exposed in equipment rooms or unfinished spaces provide field applied {aluminum} jacket.
- K. For exterior piping applications {refrigeration suction piping}, provide field applied protection jacket or coating. Insulated pipe, fittings, joints, and valves shall be covered with field applied {aluminum} jacket. Jacket seams shall be located on bottom side of horizontal piping.
- L. For return air plenum areas provide a non-combustible jacket.
- M. Fittings and valves shall be covered with pre-molded one-piece insulated covers.

- N. Piping Insulation Schedule
 - 1. Fiber Glass Insulation
 - a. Domestic Hot Water (supply and return piping):
 - pipe: up to 2" 1 inch thick
 - pipe: 2 1/2" to 4" 1 1/2 inch thick
 - b. Condensate piping system
 - pipe: up to 2" 3/4 inch thick
 - 2. Elastomeric Foam
 - a. Refrigerant Suction
 - all sizes 1 inch thick
 - b. Refrigerant Hot Gas
 - all sizes 3/4 inch thick

3.04 FLEXIBLE FIBERGLASS INSULATION WRAP BLANKET INSTALLATION AND SCHEDULE

- A. All insulation shall be applied with edges tightly butted with facing overlapping all joints at least 2". All external insulation shall have foil backed vapor seal. Joints shall be sealed with fire retardant adhesive. The insulation shall be secure to the duct with approximately 4" wide strips at 8" O.C. of fire retardant adhesive. Where the duct width exceeds 30", the underside insulation shall be additionally held in place with mechanical fasteners on about 18" maximum centers.
- B. All breaks and punctures shall be sealed with vapor barrier tape and fire retardant adhesive.
- C. Provide all insulated ductwork conveying air with foil backed jacket. Seal all jacket seams and penetrations with UL listed tapes or vapor retardant adhesive. Where service access is required, bevel and seal ends of insulation.
- D. Continue insulation through walls, sleeves, hangers, and other duct penetrations except where prohibited by code.
- E. The underside of duct work 24" or greater shall be secured with mechanical fasteners and speed clips spaced approximately 18" on center. The protruding ends of the fasteners should be cut off flush after the speed clips are installed, and then, when required, sealed with the same tape as specified above.
- F. For ductwork exposed to physical abuse in mechanical equipment rooms or in finished spaces, finish with Johns Manville Zeston® 2000 PVC jacket or aluminum jacket.

G. Flexible Fiberglass Insulation Wrap Blanket Schedule

1. Flexible Fiber Glass

a. Supply and Return Ducts @ HVAC units:

1 1/2 inch thick Foil Back Min R-8

b. Supply and Return Plenums @ HVAC units:

1 1/2 inch thick Foil Back Min R-8

2. Rigid Fiber Glass

a. Supply and Return Ducts @ HVAC units

1 1/2 inch thick Foil Back Min R-8

b. Supply and Return Plenums @ HVAC units

1 1/2 inch thick Foil Back Min R-8

3.05 DUCT LINER INSULATION INSTALLATION AND SCHEDULE

- A. Duct liner shall be used in all weather-exposed locations or outside of building. Duct liner shall be installed in all supply and return plenums for sound reduction and thermal insulation. Supply and return plenums occur at each air-moving piece of equipment. Duct liner shall also be installed where indicated on the drawings.
- B. Duct linings shall be interrupted at fire dampers and fire doors so as not to interfere with their operation. Duct coverings and linings shall also be interrupted at the immediate area of operation of heat sources in a duct system involving electric resistance or fuel burning heaters.
- C. All portions of duct designed to receive duct liner shall be completely lined on the interior with acoustical lining as specified herein. Transverse joints shall be neatly butted and there shall be no interruptions or gaps.
- D. The coated surface of the lining shall face the airstream.
- E. The lining shall be adhered to the sheet metal with 100% coverage of adhesive, and all exposed leading edges and all transverse joints coated with adhesive.
- F. The lining shall be additionally secured with mechanical fasteners that shall compress the duct liner sufficiently to hold it firmly in place.
- G. The lining shall be cut to assure overlapped and compressed longitudinal corner joints.
- H. Duct dimensions indicated are net inside dimensions required for airflow. Increase duct size to allow for insulation thickness.
- I. Sizes noted on drawings are clear cross-section area (inside the lining).

- J. For velocities up to 2,000 fpm, duct liner shall be applied with 100% coverage of fire retardant adhesive. Duct liner shall be cut to assure snug corner joints. The coated or most dense surface of the liner shall face the air stream. The liner shall be additionally secured with mechanical fasteners that shall compress the duct liner sufficiently to hold it firmly in place. They shall start within 3" of the leading edge of each duct section (and any line transverse joints within the duct section) and shall be spaced no more than 12" O.C. around the perimeter of the duct, except that they need to be no closer than 9" to a corner break. Elsewhere, they shall be a maximum of 18" O.C., except that they shall be placed not more than 6" from a cut edge nor 12" from a corner break. All exposed edges and the leading edge of all cross-joints of the liner shall be coated with the same adhesive used to secure the duct liner to the metal surface. [For velocities between 2,000 and 4,000 fpm, installation shall be same except that mechanical fasteners shall be spaced no more than 6" O.C. around the perimeter of the duct, except that they need be no closer than 6" to a corner break. Elsewhere, they shall be a maximum of 10" O.C., except that they shall be placed not more than 6" from a cut edge nor 12" from a corner break.]
- K. Adhesive shall conform to ASTM C916-85
- L. Mechanical fasteners shall conform to Mechanical Fastener Standard MF-1-1975, available from SMACNA.
- M. Adhere insulation to sheet metal with full coverage of a UL listed adhesive.
- N. Secure insulation with mechanical liner fasteners as indicated by SMACNA or manufacturer. Pin length should be as recommended by the liner manufacturer.
- O. All exposed edges of the liner must be factory or field coated. For systems operating at 4000 fpm or higher a metal nosing must be installed in all liner leading edges.
- P. Repair liner surface penetrations with UL listed adhesive.
- Q. Duct Liner Insulation Schedule - Rigid Fiber Glass
 - 1. Supply and Return Ducts as noted on drawings
 - 1 inch thick (R-6.3) LINACOUSTIC, PERMACOTE or equal
 - 2. Supply and Return Plenums for down discharge HVAC units:
 - 1 1/2 inch thick (min R-8) LINACOUSTIC, PERMACOTE or equal
 - 3. Roof Mounted or Exterior Supply and Return Duct Work from HVAC units:
 - 2 inch thick (min R-8) LINACOUSTIC, PERMACOTE or equal

END OF SECTION

SECTION 23 08 00

COMMISSIONING OF HVAC

Note to Engineers:—

All Equipment must be shown on the drawings in an equipment schedule. Refer to Division 23 Specifications and Material Standards.

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. HVAC commissioning description.
2. HVAC commissioning responsibilities.

1.02 COMMISSIONING DESCRIPTION

A. HVAC commissioning process includes the following tasks:

1. Testing and startup of HVAC equipment and systems.
2. Equipment and system verification checks.
3. Assistance in functional performance testing to verify testing and balancing, and equipment and system performance.
4. Provide qualified personnel to assist in commissioning tests, including seasonal testing.
5. Complete and endorse functional performance test checklists provided by Commissioning Authority to assure equipment and systems are fully operational and ready for functional performance testing.
6. Provide equipment, materials, and labor necessary to correct deficiencies found during commissioning process to fulfill contract and warranty requirements.
7. Provide operation and maintenance information and record drawings to Commissioning Authority for review verification and organization, prior to distribution.
8. Provide assistance to Commissioning Authority to develop, edit, and document system operation descriptions.
9. Provide training for systems specified in this Section with coordination by Commissioning Authority.

B. Equipment and Systems to Be Commissioned:

1. HVAC Units
2. ~~Chiller Units~~
3. ~~Boiler Units~~
4. ~~Pumps~~
- 5-2. Piping systems.
- 6-3. Ductwork.

- 7.4. Gas-fired heating ventilating units.
- ~~8. Gas-fired makeup air units.~~
- 9.5. Packaged roof top air conditioning units.
- ~~10.6. Split system air conditioning units.~~
- ~~11.7. Self-contained air conditioning units.~~
- ~~12.8. Fan Coil Units.~~
- ~~13.9. Fans.~~
- ~~14. Fume hoods.~~
- ~~15.10. Fire/Smoke Dampers.~~
- ~~16.11. Equipment vibration control.~~
- ~~17. Egress pressurization.~~
- ~~18. Kitchen hood supply systems.~~
- ~~19. Kitchen hood exhaust systems.~~
- 20.12. Automatic temperature control system.
- ~~21.13. Testing, Adjusting and Balancing work.~~

1.03 COMMISSIONING SUBMITTALS

- A. Draft Forms: Submit draft of system verification form and functional performance test checklist.
- B. Test Reports: Indicate data on system verification form for each piece of equipment and system as specified. Use AABC forms as guidelines.
- C. Field Reports: Indicate deficiencies preventing completion of equipment or system verification checks equipment or system to achieve specified performance.

1.04 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record revisions to equipment and system documentation necessitated by commissioning.
- B. Operation and Maintenance Data: Submit revisions to operation and maintenance manuals when necessary revisions are discovered during commissioning.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with AABC and ASHRAE Guideline.
- B. Maintain one copy of document on site.

1.06 COMMISSIONING RESPONSIBILITIES

- A. Equipment or System Installer Commissioning Responsibilities:
 - 1. Attend commissioning meetings.
 - 2. Ensure temperature controls installer performs assigned commissioning responsibilities as specified below.
 - 3. Ensure testing, adjusting, and balancing agency performs assigned commissioning responsibilities as specified.
 - 4. Provide instructions and demonstrations for Owner's personnel.
 - 5. Ensure subcontractors perform assigned commissioning responsibilities.

6. Ensure participation of equipment manufacturers in appropriate startup, testing, and training activities when required by individual equipment specifications.
 7. Develop startup and initial checkout plan using manufacturer's startup procedures and functional performance checklists for equipment and systems to be commissioned.
 8. During verification check and startup process, execute HVAC related portions of checklists for equipment and systems to be commissioned.
 9. Perform and document completed startup and system operational checkout procedures, providing copy to Commissioning Authority.
 10. Provide manufacturer's representatives to execute starting of equipment. Ensure representatives are available and present during agreed upon schedules and are in attendance for duration to complete tests, adjustments and problem-solving.
 11. Coordinate with equipment manufacturers to determine specific requirements to maintain validity of warranties.
 12. Provide personnel to assist Commissioning Authority during equipment or system verification checks and functional performance tests.
 13. Prior to functional performance tests, review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during tests.
 14. Prior to startup, inspect, check, and verify correct and complete installation of equipment and system components for verification checks included in commissioning plan. When deficient or incomplete work is discovered, ensure corrective action is taken and re-check until equipment or system is ready for startup.
 15. Provide factory supervised startup services for equipment and systems specified in Section 23 20 00. Coordinate work with manufacturer and Commissioning Authority.
 16. Perform verification checks and startup on equipment and systems as specified.
 17. Assist Commissioning Authority in performing functional performance tests on equipment and systems as specified.
 18. Perform operation and maintenance training sessions scheduled by Commissioning Authority.
 19. Conduct HVAC system orientation and inspection.
- B. Temperature Controls Installer Commissioning Responsibilities:
1. Attend commissioning meetings.
 2. Review design for ability of systems to be controlled including the following:
 - a. Confirm proper hardware requirements exist to perform functional performance testing.
 - b. Confirm proper safeties and interlocks are included in design.

- c. Confirm proper sizing of system control valves and actuators and control valve operation will result capacity control identified in Contract Documents.
 - d. Confirm proper sizing of system control dampers and actuators and damper operation will result in proper damper positioning.
 - e. Confirm sensors selected are within device ranges.
 - f. Review sequences of operation and obtain clarification from Architect/Engineer.
 - g. Indicate delineation of control between packaged controls and building automation system, listing BAS monitor points and BAS adjustable control points.
 - h. Provide written sequences of operation for packaged controlled equipment. Equipment manufacturers' stock sequences may be included, when accompanied by additional narrative to reflect Project conditions.
- 3. Inspect, check, and confirm proper operation and performance of control hardware and software provided in other HVAC sections.
- 4. Submit proposed procedures for performing automatic temperature control system point-to-point checks to Commissioning Authority and Architect/Engineer.
- 5. Inspect check and confirm correct installation and operation of automatic temperature control system input and output device operation through point-to-point checks.
- 6. Perform training sessions to instruct GUHSD Facility personnel in hardware operation, software operation, programming, and application in accordance with commissioning plan and requirements of Section 23 09 00.
- 7. Demonstrate system performance and operation to Commissioning Authority during functional performance tests including each mode of operation.
- 8. Provide control system technician to assist during Commissioning Authority verification check and functional performance testing.
- 9. Provide control system technician to assist testing, adjusting, and balancing agency during performance of testing, adjusting, and balancing work.
- 10. Assist in performing operation and maintenance training sessions scheduled by Commissioning Authority.
- C. Testing, Adjusting, and Balancing Agency Commissioning Responsibilities:
 - 1. Attend commissioning meetings.
 - 2. Participate in verification of testing, adjusting, and balancing report for verification or diagnostic purposes. Repeat sample of ~~{40}~~ {20} percent of measurements contained in testing, adjusting, and balancing report ~~{as indicated in commissioning plan.}~~ [as selected by Commissioning Authority.]

3. Assist in performing operation and maintenance training sessions scheduled by Commissioning Authority.

1.07 COMMISSIONING MEETINGS

- A. Attend initial commissioning meeting and progress commissioning meetings as required by Commissioning Authority.

1.08 SCHEDULING

- A. Prepare schedule indicating anticipated start dates for the following:
 1. Piping system pressure testing.
 2. Piping system flushing and cleaning.
 3. Ductwork cleaning.
 4. Ductwork pressure testing.
 5. Equipment and system startups.
 6. Automatic temperature control system checkout.
 7. Testing, adjusting, and balancing.
 8. HVAC system orientation and inspections.
 9. Operation and maintenance manual submittals.
 10. Training sessions.
- B. Schedule seasonal tests of equipment and systems during peak weather conditions to observe full-load performance.
- C. Schedule occupancy sensitive tests of equipment and systems during conditions of both minimum and maximum occupancy or use.

1.09 COORDINATION

- A. Notify Commissioning Authority minimum of {four}-[] weeks in advance of the following:
 1. Scheduled equipment and system startups.
 2. Scheduled automatic temperature control system checkout.
 3. Scheduled start of testing, adjusting, and balancing work.
- B. Coordinate programming of automatic temperature control system with construction and commissioning schedules.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install additional balancing dampers, balancing valves, access doors, test ports, and pressure and temperature taps required by {Commissioning Authority.}[commissioning plan.]
- B. Place HVAC systems and equipment into full operation and continue operation during each working day of commissioning.
- C. Install replacement sheaves and belts to obtain system performance, as requested by Commissioning Authority.

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- D. Install test holes in ductwork and plenums as requested by Commissioning Authority for taking air measurements. Refer to Section 23 05 00.
- E. Prior to start of functional performance test, install replacement filters in equipment as specified in individual section.

3.02 COMMISSIONING

- A. Seasonal Sensitive Functional Performance Tests:
 - 1. Test heating equipment at winter design temperatures.
 - 2. Test cooling equipment at summer design temperatures [with fully occupied building].
- B. Be responsible to participate in initial and alternate peak season test of systems required to demonstrate performance.
- C. Occupancy Sensitive Functional Performance Tests:
 - 1. Test equipment and systems affected by occupancy variations at minimum and peak loads to observe system performance.

END OF SECTION

SECTION 23 09 00

INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.01 SUMMARY

- A. Work under this section includes providing instrumentation and controls for equipment related to Heating, Ventilating, Air Conditioning and Refrigeration systems.
- B. Provide complete HVAC Control Submittals and Shop drawings. Refer to Section 23 01 00 paragraph 1.4 Submittals - Shop Drawings/Product Data/Material Certifications.
- C. Provide a fully integrated "Web Based" HVAC Control System, incorporating direct digital control (DDC) for energy management, equipment monitoring and control, subsystems with open communications capabilities as herein specified.
- D. Complete Web Based HVAC Control System to be DDC with electric actuation as specified herein.
- E. Provide wiring, conduit, panels, and accessories for a complete operational HVAC systems.
- F. HVAC Control Contractor/Manufacture shall be responsible for all electrical work associated with the HVAC Control Systems.
- G. Perform all wiring in accordance with all local and national codes.
- H. Install all line voltage "control" wiring, concealed or exposed, in conduit in accordance with the division 26 specifications, NEC and local building code.
- I. Provide system graphics for each controlled device and/or integrated system. Origin of information shall be transparent to the operator and shall be controlled, displayed, trended, etc. as if the points were hardwired to the HVAC Control System.
- J. Provide minimum one (1) Primary Web Based DDC panel per building.
- K. The application specific controllers installed for the mechanical units will be connected to the primary panel.
- L. Provide Stand-alone Application Specific Controllers (ASCs) for terminal equipment.

1.02 GENERAL PRODUCT DESCRIPTION FOR WEB BASED DIRECT DIGITAL CONTROL SYSTEM

- A. The installation of the Web Based Direct Digital HVAC Control System shall be performed under the direct supervision of the HVAC Control Contractor/Manufacturer with the shop drawings, flow diagrams, bill of materials, component designation, or identification number and sequence of operation all bearing the name of the manufacturer. The installing HVAC Control Contractor/Manufacturer shall certify in writing, that the shop drawings have been prepared by the HVAC Control Contractor/Manufacturer and that the HVAC Control Contractor/Manufacturer has supervised their installation.
- B. HVAC Control Contractor/Manufacturer shall certify, in writing, that the shop drawings were prepared by their company and that all temperature control equipment was installed under their direct supervision.
- C. All materials and equipment used shall be standard components, regularly manufactured for this and/or other systems and not custom designed specially for this project. All systems and components shall have been thoroughly tested and proven in actual use for at least two years.
- D. The system shall be scalable in nature and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, DDC Controllers, and operator devices.
- E. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. Each DDC Controller shall operate independently by performing its own specified control, alarm management, operator I/O, and data collection. The failure of any single component or network connection shall not interrupt the execution of any control strategy, reporting, alarming and trending function, or any function at any operator interface device.
- F. DDC Controllers shall be able to access any data from, or send control commands and alarm reports directly to, any other DDC Controller or combination of controllers on the network without dependence upon a central or intermediate processing device. DDC Controllers shall also be able to send alarm reports to multiple operator workstations without dependence upon a central or intermediate processing device.
- G. DDC Controllers shall be able to assign password access and control priorities to each point individually. The Logon password for the Web Based system at any PC workstation or portable operator terminal shall enable the operator to monitor, adjust or control only the points that the operator is authorized for. All other points shall not be displayed at the PC workstation or portable terminal. (e.g. all base building and all tenant points shall be accessible to any base building operators, but only certain base building and tenant points shall be accessible to tenant building operators). Passwords and priority levels for every point shall be fully programmable and adjustable.

1.03 APPROVED HVAC CONTROL SYSTEM CONTRACTORS/MANUFACTURERS

- A. The following is the preferred manufacturer:
 - 1. Honeywell International Inc. – R & R Controls Inc.
4564 B Alvarado Canyon Road, San Diego, California 92120
Phone: 619-516-1880; Fax: 619-516-1881
Contact: Rick Des Lauriers

- B. Equal manufacturers – Carrier Controls, or Johnson Controls, Inc. Metasys Building Automation Systems.

1.04 QUALITY ASSURANCE

- A. HVAC Control Contractor/Manufacture shall have designed, installed and commissioned similar projects. HVAC Control Contractor/Manufacture shall have an in-place support facility within 25 miles of the site with technical staff, spare parts inventory and necessary test and diagnostic equipment.
- B. HVAC Control Contractor/Manufacture shall provide full time, on site, experienced project manager for this work, responsible for direct supervision of the design, installation, start up and commissioning of the HVAC Controls System.
- C. HVAC Control Contractor/Manufacture regularly engaged in the installation and maintenance of HVAC Controls Systems and shall have a minimum of ten (10) years of demonstrated technical expertise and experience in the installation and maintenance of HVAC Controls Systems similar in size and complexity to this project.
- D. HVAC Control Contractor/Manufacture shall maintain a service organization consisting of factory trained service personnel and provide a list of 10 projects, similar in size and scope to this project, completed within the last five years.
- E. Materials and equipment shall be the catalogued products of manufacturers regularly engaged in production and installation of automatic temperature control systems and shall be manufacturer's latest standard design that complies with the specification requirements.
- F. HVAC Control Contractor/Manufacture peer-to-peer network controllers, central system controllers, and local user displays shall be UL Listed under Standard UL 916, category PAZX; Standard ULC C100, category UUKL7; and under Standard UL 864, categories UUKL, UDTZ, and QVAX and be so listed at the time of bid. All floor level controllers shall comply, at a minimum, with UL Standard UL 916 category PAZX; Standard UL 864, categories UDTZ, and QVAX and be so listed at the time of Bid.
- G. HVAC Control Contractor/Manufacture peer-to-peer network controllers and local user display shall also comply with the European Electromagnetic Compatibility (EMC) Framework, and bear the C-Tic Mark to show compliance. The purpose of the regulation is to minimize electromagnetic interference between electronic products, which may diminish the performance of electrical products or disrupt essential communications.
- H. DDC peer-to-peer controllers shall be compliant with the European EMC Directive, Standards EN 61000-6-4, at the Industrial Levels. Additionally the equipment shall be compliant with the European LVD Directive and bear the CE mark in order to show compliance to both directives.
- I. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference and be so labeled.
- J. The manufacturer of the building automation system shall provide documentation supporting compliance with ISO 9001 (Quality Management Systems) and ISO/NP 14001 (Environmental Management Systems). The intent of this specification requirement is to ensure that the products from the manufacturer are delivered through a Quality System and Framework that will assure consistency in the products delivered for this project.

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- K. HVAC Control Contractor/Manufactures have a documented history of compatibility by design for a minimum of 15 years. Future compatibility shall be supported for no less than 10 years. Compatibility shall be defined as the ability to upgrade existing field panels to current level of technology, and extend new field panels on a previously installed network. Compatibility shall be defined as the ability for any existing field panel microprocessor to be connected and directly communicate with new field panels without bridges, routers or protocol converters.

1.05 WARRANTY PERIOD - 2 YEAR

- A. Warrant labor and materials for specified control system free from defects for a period of 2 years after final acceptance by School District.
- B. All components, system software, and parts furnished and installed by the HVAC Control Contractor/Manufacture shall be guaranteed against defects in materials and workmanship for two year from acceptance date.
- C. Labor to repair, reprogram, or replace these components shall be furnished by the HVAC Control Contractor/Manufacture at no charge during the two year warranty period.
- D. All corrective software modifications made during two year warranty period shall be updated on all user documentation and on user and manufacturer archived software disks.
- E. HVAC Control Contractor/Manufacture shall respond to the School District request for warranty service within 24 hours during normal business hours.
- F. Operator workstation software, project-specific software, graphic software, database software, and firmware updates which resolve known software deficiencies as identified by the HVAC Control Contractor/Manufacture shall be provided to the Grossmont Union High School District at no charge during the two year warranty period.
- G. Any upgrades or functional enhancements associated with the above mentioned items may be provided during the two year warranty period for an additional charge to the Grossmont Union High School District by purchasing an in-warranty service agreement from the HVAC Control Contractor/Manufacture.
- H. Failures on control systems that include all computer equipment, transmission equipment and all sensors and control devices during warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Grossmont Union High School District.
- I. Respond during normal business hours within 24 hours of Grossmont Union High School District's warranty service request.
- J. Work shall have a single warranty date, even if Grossmont Union High School District receives beneficial use due to early system start-up. If specified work is split into multiple contracts or a multi-phase contract, each contract or phase shall have a separate warranty start date and period.
- K. Date of acceptance shall begin warranty period.
- L. Provide updates to operator workstation software, project-specific software, graphic software, database software, and firmware that resolve HVAC Control Contractor/Manufacture identified software deficiencies at no charge during warranty period.

M. Ownership of Proprietary Material

1. Project specific software and documentation shall become Grossmont Union High School District's property. This includes, but not limited to:
 - a. Graphics
 - b. Record drawings
 - c. Database
 - d. Application programming code

N. Documentation

1. General
 - a. Submit three (3) copies of owner's manuals upon completion of project.
 - b. Submit two (2) electronic copies of complete as-built documentation on CD ROM. All drawings shall be in standard AutoCad 2007 (or newer) format, other documentation shall be in standard MS Office format.
 - c. Update manuals with modifications made to system during guarantee period. Provide replacement pages or supplements in quantity stated above for "as built" manuals.
 - d. Assemble owner's manuals into multi-volume sets as necessary and required by Grossmont Union High School District.
 - e. Protect each volume with a heavy duty binder. Volumes to have plastic printed dividers between major sections and have oversized binders to accommodate up to 1/2-inch thick set of additional information.
 - f. Each binder to be printed with project name and volume title on front cover and binder.

O. Operating manual to serve as training and reference manual for all aspects of day-to-day operation of the system. As a minimum include the following:

1. Sequence of operation for automatic and manual operating modes for all building systems. The sequences shall cross reference the system point names.
2. HVAC Control Contractor/Manufacture operating manuals.

P. Provide maintenance manual to serve as training and reference manual for all aspects of day-to-day maintenance and major system repairs. As a minimum include the following:

1. Complete as-built installation drawings for each building system.
2. Overall system electrical power supply schematic indicating source of electrical power for each system component. Indicate all battery backup provisions.
3. Parts lists with manufacturer's catalog numbers and ordering information.
4. Manufacturer's operation, set-up, maintenance and catalog literature for each piece of equipment.
5. Maintenance and repair instructions.
6. Recommended spare parts.

- Q. Provide Programming Manual to serve as training and reference manual for all aspects of system programming. As a minimum include the following:
1. Complete programming manuals, and reference guides.
 2. Details of any custom software packages and compilers supplied with system.
 3. Information and access required for independent programming of system.

1.06 CODES AND STANDARDS

- A. Work, materials, and equipment shall comply with the most restrictive of local, state, and federal authorities' codes and ordinances or these plans and specifications. As a minimum, the installation shall comply with current editions in effect 30 days prior to receipt of bids of the following codes:
1. National Electric Code (NEC)
 2. ANSI/ASHRAE Standard 135 - 2016, BACnet--A Data Communication Protocol for Building Automation and Control Networks

1.07 SYSTEM PERFORMANCE

- A. Performance Standards. System shall conform to the following minimum standards over network connections. Systems shall be tested using manufacturer's recommended hardware and software for operator workstation (server and browser for web-based systems).
1. Graphic Display. A graphic with 20 dynamic points shall display with current data within 10 sec.
 2. Graphic Refresh. A graphic with 20 dynamic points shall update with current data within 8 sec. and shall automatically refresh every 15 sec.
 3. Alarm Response Time. An object that goes into alarm shall be annunciated at the workstation within 15 sec.
 4. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 sec. Select execution times consistent with the mechanical process under control.
 5. Performance. Programmable controllers shall be able to completely execute DDC control loops at a frequency adjustable down to once per sec. Select execution times consistent with the mechanical process under control.
 6. Multiple Alarm Annunciations. Each workstation on the network shall receive alarms within 5 sec of other workstations.

1.08 SUBMITTALS

- A. Product Submittal Requirements:
- B. Provide six copies of shop drawings and other submittals on hardware, software, and equipment to be installed or furnished.
- C. Begin no work until submittals have been approved for conformity with design intent.
- D. Provide drawings as AutoCAD 2014 (or newer) compatible files on optical disk (file format: .dwg, .dxf, .vsd, or comparable) or hard copies on 11" x 17" prints of each drawing.

- E. When manufacturer's cutsheets apply to a product series rather than a specific product, clearly indicate applicable data by highlighting or by other means. Clearly reference covered specification and drawing on each submittal. General catalogs shall not be accepted as cut sheets to fulfill submittal requirements. Select and show submittal quantities appropriate to scope of work.
- F. Provide submittals within 8 weeks of contract award.
- G. Additional submittal data shall consist of the following:
 - 1. Direct Digital Control System Hardware:
 - a. Complete bill of materials indicating quantity, manufacturer, model number, and relevant technical data of equipment to be used.
 - b. Manufacturer's description and technical data, such as product specification sheets, installation and maintenance instructions for items listed below and for relevant items not listed below:
 - c. Direct Digital Controllers (controller panels)
 - d. Transducers and transmitters
 - e. Sensors (including accuracy data)
 - f. Valves
 - g. Dampers
 - h. Relays and Switches
 - i. Control Panels
 - j. Power Supplies
 - k. Operator Interface Equipment
 - l. Wiring diagrams and layouts for each control panel. Show all termination numbers.
 - 2. Central System Hardware and Software:
 - a. Provide sample color graphics on 11" x 17" prints for each typical system indicating conceptual layout of pictures and data for each graphic. List of color graphics to be provided showing or explaining which other graphics can be directly accessed.
 - b. Provide a list of points naming convention. Indicate the format, structure and standards of typical point names. The naming convention shall follow the "Global_Campus_Building_Area_Equipment_Function" format. Provide a list of point names for typical equipment and functions with specific examples.

3. Controlled Systems:
 - a. Riser diagrams showing control network layout, communication protocol, and wire types.
 - b. Schematic diagram of each controlled system. Label control points with point names. Graphically show locations of control elements.
 - c. Schematic wiring diagram of each controlled system. Label control elements and terminals. Where a control element is also shown on control system schematic, the same name shall be used.
 - d. Instrumentation list for each controlled system. List control system element in a table. Show element name, type of device, manufacturer, model number, and product data sheet number.
 - e. Complete description of control system operation including sequences of operation. Include and reference schematic diagram of controlled system.
 - f. Point list for each system controller including both inputs and outputs (I/O), point numbers, controlled device associated with each I/O point, and location of I/O device.
4. Description of process, report formats and checklists to be used in Part 3: "Control System Demonstration and Acceptance."
5. Contractor shall submit documentation in the following phased delivery schedule:
 - a. System schematics, including:
 01. System Riser Diagrams
 02. Sequence of Operations
 03. Mechanical Control Schematics
 04. Electrical Wiring Diagrams
 05. Control Panel Layouts
 06. Product Specification Sheets
 07. As-Built drawings
- H. Project Record Documents: Submit three copies of record (as-built) documents upon completion of installation. Submittal shall consist of:
 1. Project Record Drawings. As-built versions of the submittal shop drawings provided as PDF format, native AutoCAD 2014 (or newer) compatible files on optical media and as 11" x 17" prints.
 2. Testing and Commissioning Reports and Checklists. Completed versions of reports, checklists, and trend logs.
 3. Operation and Maintenance (O & M) Manual.
 - a. As-built versions of the submittal product data.
 - b. Names, addresses, and 24-hour telephone numbers of installing contractors and service representatives for equipment and control systems.

- c. Operator's Manual with procedures for operating control systems, logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing set points and variables.
 - d. Programming manual or set of manuals with description of programming language and of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.
 - e. Engineering, installation, and maintenance manual or set of manuals that explains how to design and install new points, panels, and other hardware; how to perform preventive maintenance and calibration; how to debug hardware problems; and how to repair or replace hardware.
 - f. Documentation of all programs created using custom programming language, including set points, tuning parameters, and object database.
 - g. Graphic files, programs, and database on magnetic or optical media.
 - h. List of recommended spare parts with part numbers and suppliers.
 - i. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware, including computer equipment and sensors.
 - j. Complete original original-issue copies of furnished software, including operating systems, custom programming language, operator workstation software, and graphics software.
 - k. Licenses, guarantees, and warranty documents for equipment and systems.
- l. Training Materials. Provide course outline and manuals at least two weeks before training.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. All products used in this project installation shall be new and currently manufactured and shall have been applied in similar installations. Spare parts shall be available for at least five years after completion of this contract.

2.02 COMMUNICATION

- A. The design of the HVAC Control System shall support networking of operator workstations and building controllers and shall allow the co-existence of new DDC controllers with existing DDC controllers in the same network without the use of gateways or protocol converters. The network architecture shall consist of multiple levels, an Ethernet based Management Level Network (MLN) between buildings for all operator workstations, servers, and some primary DDC controllers, an EIA-485 based Building Level Network (BLN) between primary DDC controllers within buildings, and Floor Level Networks (FLN) for terminal equipment application specific controllers.

- B. Access to system data shall not be restricted by the hardware configuration of the building management system. The hardware configuration of the HVAC Control System network shall be totally transparent to the user when accessing data or developing control programs.
- C. Operator Workstation Communication:
 - 1. All color graphic operator workstations shall reside on the Ethernet network and the consoles shall be set up in a client/server configuration.
 - 2. The servers will act as the central database for system graphics and databases to provide consistency throughout all system workstations.
 - 3. The network shall allow concurrent use of multiple HVAC Control System software site licenses.
- D. Management Level Network Communication (MLN)
 - 1. All PCs shall simultaneously direct connect to the Ethernet Management Level Network without the use of an interposing device.
 - 2. Operator Workstation shall be capable of simultaneous direct connection and communication with BACnet/IP, OPC and TCP/IP corporate level networks without the use of interposing devices.
 - 3. The Primary Network shall not impose a maximum constraint on the number of operator workstations.
 - 4. Any controller residing on the primary network shall connect to Ethernet network without the use of a PC or a gateway with a hard drive.
 - 5. Any PC on the Primary Network shall have transparent communication with controllers on the building level networks connected via Ethernet.
 - 6. Any break in Ethernet communication from the PC to the controllers on the Primary Network shall result in a notification at the PC.
 - 7. The standard client and server workstations on the Primary Network shall reside on industry standard Ethernet utilizing standard TCP/IP, IEEE 802.3.
 - 8. System software applications will run as a service to allow communication with Primary Network Controllers without the need for user log in. Closing the application or logging off shall not prevent the processing of alarms, network status, panel failures, and trend information.
 - 9. Any break in Ethernet communication between the standard client and server workstations on the Primary Network shall result in a notification at each workstation.
 - 10. Access to the system database shall be available from any standard client workstation on the Primary Network.
 - 11. Client access to client-server workstation configurations over the Internet network shall be available via Web browser interface.

12. Thin Client access to client-server workstation configurations via Windows Terminal Services shall provide multiple, independent sessions of the workstations software. Terminal Services clients shall have full functionality, without the need to install the workstation software on the local hard drive.
- E. Primary Network (MLN + BLN) - Panel to Panel Communication:
1. All Building Controllers shall directly reside on the MLN (Ethernet network) between buildings or BLN (EIA-485 network) within buildings such that communications may be executed directly between Building Controllers, directly between server and Building Controllers on a peer-to-peer basis.
 2. Systems that operate via polled response or other types of protocols that rely on a central processor, file server, or similar device to manage panel-to-panel or device-to-device communications shall not be acceptable.
 3. All operator interfaces shall have the ability to access all point status and application report data or execute control functions for any and all other devices. Access to data shall be based upon logical identification of building equipment. No hardware or software limits shall be imposed on the number of devices with global access to the network data.
 4. The MLN shall use TCP/IP over Ethernet. All devices must:
 - a. Auto-sense 10/100 Mbps networks.
 - b. Receive an IP Address from a Dynamic Host Configuration Protocol (DHCP) Server or be configured with a Fixed IP Address.
 - c. Resolve Name to IP Addresses for devices using a Domain Name Service (DNS) Server on the Ethernet network.
 - d. Allow MMI access to an individual Primary Network Controller using industry standard Telnet software to view and edit entire Primary Network.
 5. The primary network shall provide the following minimum performance:
 - a. Provide high-speed data transfer rates for alarm reporting, report generation from multiple controllers and upload/download efficiency between network devices. System performance shall insure that an alarm occurring at any Building Controller is displayed at any PC workstations, all Building controllers, and other alarm printers within 15 seconds.
 - b. Message and alarm buffering to prevent information from being lost.
 - c. Error detection, correction, and re-transmission to guarantee data integrity.
 - d. Synchronization of real-time clocks between Building Controllers, including automatic daylight savings time corrections.

- e. The primary network shall allow the Building Controllers to access any data from, or send control commands and alarm reports directly to, any other Building Controller or combination of controllers on the network without dependence upon a central or intermediate processing device. Building Controllers shall send alarm reports to multiple operator workstations without dependence upon a central or intermediate processing device. The network shall also allow any Building controller to access, edit, modify, add, delete, back up, restore all system point database and all programs.
- f. The primary network shall allow the Building Controllers to assign password access and control priorities to each point individually. The logon password (at any PC workstation or portable operator terminal) shall enable the operator to monitor, adjust and control only the points that the operator is authorized for. All other points shall not be displayed at the PC workstation or portable terminal. (e.g. all base building and all tenant points shall be accessible to any base building operators, but only certain base building and tenant points shall be accessible to tenant building operators). Passwords and priorities for every point shall be fully programmable and adjustable.
- g. Devices containing custom programming must reside on the Primary Network

F. Secondary Network (FLN) - Application Specific Controller Communication:

- 1. Communication over the FLN shall be the manufacturer's standard protocol.
- 2. This level communication shall support a family of application specific controllers for terminal equipment.
- 3. The Application Specific Controllers shall communicate bi-directionally with the primary network through Building Controllers for transmission of global data.
- 4. A maximum of 30 terminal equipment controllers may be configured on individual secondary network trunks to insure adequate global data and alarm response times.

G. Internet Based Communication:

- 1. Web Based Operator Interface:
 - a. APOGEE GO for Siemens Building Technologies, Inc.
 - b. Metasys® Building Automation Systems for Johnson Controls, Inc.
 - c. WEBStation – AX for Honeywell International Inc.
 - d. The HVAC Control System shall provide a web based graphical interface that allows users to access the HVAC Control System data via the Internet, extranet, or Intranet. The interface shall use HTML based ASP pages to send and receive data from the HVAC Control System to a web browser.

- e. A web server computer will be supplied. The web server shall use Microsoft's IIS server 4.0 with Windows NT4, or IIS 5.0 with Windows 2000, and support browser access via Microsoft Internet Explorer 5.0 (or higher), or Navigator Netscape 6.0 (or higher).
- f. All information exchanged over Internet shall be optionally encrypted and secure via SSL (provided by Grossmont Union High School District).
- g. Access to the web interface may be password protected. Users' rights and privileges to points and graphics will be the same as those assigned at the HVAC Control System workstation. An option will exist to only allow users "read" access via the web browser, while maintaining "command" privileges via the HVAC Control System workstation.
- h. The web interface shall not require modification or creation of HTML or ASP pages using an HTML editor. All graphics available at the HVAC Control System graphical workstation shall be automatically generated to a web server.
- i. The web based interface shall provide the following functionality to users, based on their access and privilege rights:
 - 01. Logon Screen - allows the user to enter their name, password and domain name for logging into the web server.
 - 02. Alarm Display - a display of current HVAC Control System alarms to which the user has access will be displayed. Users will be able to acknowledge and erase active alarms, and link to additional alarm information including alarm messages. Any alarm acknowledgments initiated through the web interface will be recorded to the HVAC Control System activity log.
 - 03. Graphic Display - Display of system graphics, including animated motion, available in the HVAC Control System workstation will be available for viewing over the web browser. Software that requires the creation of dedicated "web" graphics in order to display the system via the browser interface will not be acceptable. A graphic selector list will allow users to select any graphics to which they have access. Graphics displays will automatically refresh with the latest change of values. Users will have the ability to command and override points from the graphic display as determined by their user account rights.
 - 04. Point Details - users will have access to point detail information including operational status, operational priority, physical address, and alarm limits, for point objects to which they have access.
- j. Point Commanding - users will be able to override and command points they have access to via the web browser interface. Any commands or overrides initiated via the web browser interface will be written to the HVAC Control System central workstation activity log.
- k. The web server licensing options will allow concurrent access by a minimum of five (5) browser connections.

- I. Internet connections, ISP services, as well as necessary firewalls or proxy servers shall be provided by the Grossmont Union High School District as required to support the web access feature.
2. Terminal Services Operator Interface
 - a. Client access to client-server workstation configurations over low-bandwidth network technologies shall be available optionally via Windows Terminal Services or Web browser interface. Remote client access via Windows Terminal Services shall provide multiple, independent sessions of the workstations software – Terminal Services clients shall have workstation software access, without the need to install the workstation software on the local hard drive.

H. Remote Notification Paging System:

1. Workstations shall be configured to send out messages to numeric pagers, alphanumeric pagers, phones (via text to speech technology), SMS (Simple Messaging Service, text messaging) Devices, and email accounts based on a point's alarm condition.
2. There shall be no limit to the number of points that can be configured for remote notification of alarm conditions and no limit on the number of remote devices which can receive messages from the system.
3. On a per point basis, system shall be configurable to send messages to an individual or group and shall be configurable to send different messages to different remote devices based on alarm message priority level.
4. Remote devices may be scheduled as to when they receive messages from the system to account for operators' work schedules.
5. System must be configurable to send messages to an escalation list so that if the first device does not respond, the message is sent on to the next device after a configurable time has elapsed.
6. Message detail shall be configurable on a per user basis.
7. During a "flood" of alarms, remote notification messages shall have the ability to optimize several alarms into an individual remote notification message.
8. Workstation shall have the ability to send manual messages allowing an operator to type in a message to be sent immediately.
9. Workstation shall have a feature to send a heartbeat message to periodically notify users that they have communication with the system.

2.11 OPERATOR INTERFACE:

A. Workstation hardware:

1. Provide new operator's workstation to interface with the new DDC equipment installed under this contract.

B. Server hardware:

1. Provide new server shall be used to interface with the new DDC equipment installed under this contract.

C. Operator Interface Software:

1. Operator interface software shall minimize operator training through the use of user-friendly and interactive graphical applications, 30-character English language point identification, on-line help, and industry standard Windows application software. Interface software shall simultaneously communicate with and share data between Ethernet-connected building level networks.
2. Provide a graphical user interface that shall minimize the use of keyboard through the use of a mouse or similar pointing device, with a "point and click" approach to menu selection and a "drag and drop" approach to inter-application navigation.

The navigation shall be user friendly by utilizing "forward & back" capability between screens and embedded hyperlinks to open graphics, documents, drawings, etc.

3. Selection of applications within the operator interface software shall be via a graphical toolbar menu – the application toolbar menu shall have the option to be located in a docked position on any of the four sides of the visible desktop space on the workstation display monitor, and the option to automatically hide itself from the visible monitor workspace when not being actively manipulated by the user.
4. The software shall provide a multi-tasking type environment that allows the user to run several applications simultaneously. HVAC Control System software shall run on a Windows XP, 2000, or comparable 32 bit operating system. System database parameters shall be stored within an object-oriented database. Standard Windows applications shall run simultaneously with the HVAC Control System software. The mouse or Alt-Tab keys shall be used to quickly select and switch between multiple applications. The operator shall be able to work in Microsoft Word, Excel, and other Windows based software packages, while concurrently annunciating on-line HVAC Control System alarms and monitoring information
5. The software shall provide, as a minimum, the following functionality:
 - a. Real-time graphical viewing and control of the HVAC Control System environment
 - b. Reporting
 - c. Scheduling and override of building operations
 - d. Collection and analysis of historical data
 - e. Point database editing, storage and downloading of controller databases.
 - f. Utility for combining points into logical Point Groups. The Point Groups shall then be manipulated in Graphics, trend graphs and reports in order to streamline the navigation and usability of the system.

- g. Alarm reporting, routing, messaging, and acknowledgment
- h. "Collapsible tree," dynamic system architecture diagram application: Showing the real-time status and definition details of all workstations and devices on a management level network showing the real-time status and definition details of all Building Controllers at the Primary Network. Showing the definition details of all application specific controllers
- i. Definition and construction of dynamic color graphic displays.
- j. Online, context-sensitive help, including an index, glossary of terms, and the capability to search help via keyword or phrase.
- k. On-screen access to User Documentation, via online help or PDF-format electronic file.
- l. Automatic database backup at the operator interface for database changes initiated at Building Controllers.
- m. Display dynamic trend data graphical plot.
- n. Program editing
- o. Transfer trend data to 3rd party spreadsheet software
- p. Enhanced Functionality:
- q. Provide functionality such that any of the following may be performed simultaneously on-line, and in any combination, via adjustable user-sized windows. Operator shall be able to drag and drop information between the following applications, reducing the number of steps to perform a desired function (e.g., Click on a point on the alarm screen and drag it to the dynamic trend graph application to initiate a dynamic trend on the desired point):
- r. Report and alarm printing shall be accomplished via Windows Print Manager, allowing use of network printers.
- s. Security: Operator-specific password access protection shall be provided to allow the administrator/manager to limit users' workstation control, display and data base manipulation capabilities as deemed appropriate for each user, based upon an assigned password. Operator privileges shall "follow" the operator to any workstation logged onto (up to 999 user accounts shall be supported). The administrator or manager shall be able to grant discrete levels of access and privileges, per user, for each point, graphic, report, schedule, and HVAC Control System workstation application. And each HVAC Control System workstation user account shall use a Windows Operating System user account as a foundation.

- t. The operator interface software shall also include an application to track the actions of each individual operator, such as alarm acknowledgement, point commanding, schedule overriding, database editing, and logon/logoff. The application shall list each of the actions in a tabular format, and shall have sorting capabilities based on parameters such as ascending or descending time of the action, or name of the object on which the action was performed. The application shall also allow querying based on object name, operator, action, or time range.
- u. Dynamic Color Graphics application.
- v. Reports shall be generated on demand or via pre-defined schedule, and directed to CRT displays, printers or file. As a minimum, the system shall allow the user to easily obtain the following types of reports:
 - 01. A general listing of all or selected points in the network
 - 02. List of all points currently in alarm
 - 03. List of all points currently in override status
 - 04. List of all disabled points
 - 05. List of all points currently locked out
 - 06. List of user accounts and access levels
 - 07. List all weekly schedules and events
 - 08. List of holiday programming
 - 09. List of control limits and deadbands
 - 10. Custom reports from 3rd party software
 - 11. System diagnostic reports including, list of Building panels on line and communicating, status of all Building terminal unit device points
 - 12. List of programs
 - 13. List of point definitions
 - 14. List of logical point groups
 - 15. List of alarm strategy definitions
 - 16. List of Building Control panels
 - 17. Point totalization report
 - 18. Point Trend data listings
 - 19. Initial Values report
 - 20. User activity report

- w. Scheduling and override
 - 01. Provide a calendar type format for simplification of time and date scheduling and overrides of building operations. Schedule definitions reside in the PC workstation and in the Building Controller to ensure time equipment scheduling when PC is off-line, PC is not required to execute time scheduling. Provide override access through menu selection, graphical mouse action or function key. Provide the following capabilities as a minimum:
- x. Collection and Analysis of Historical Data
 - 01. Provide trending capabilities that allow the user to easily monitor and preserve records of system activity over an extended period of time. Any system point may be trended automatically at time-based intervals (up to four time-based definitions per point) or change of value, both of which shall be user-definable. Trend data shall be collected stored on hard disk for future diagnostics and reporting. Automatic Trend collection may be scheduled at regular intervals through the same scheduling interface as used for scheduling of zones, events, and reports. Additionally, trend data may be archived to network drives or removable disk media for future retrieval.
- y. Dynamic Color Graphic Displays
 - 01. Capability to create color graphic floor plan displays and system schematics for each piece of mechanical equipment, including, but not limited to, air handling units, chilled water systems, hot water boiler systems, and room level terminal units.
- z. System Configuration & Definition
 - 01. A "Collapsible tree," dynamic system architecture diagram/display application of the site-specific HVAC Control System architecture showing status of controllers, PC workstations and networks shall be provided. This application shall include the ability to add and configure workstations, Building Controllers, as well as 3rd-party integrated components. Symbols/icons representing the system architecture components shall be user-configurable and customizable, and a library of customized icons representing 3rd-party integration solutions shall be included. This application shall also include the functionality for real-time display, configuration and diagnostics connections to Building Controllers.
- aa. Alarm Management
 - 01. Alarm Routing shall allow the user to send alarm notification to selected printers or workstation location(s) based on time of day, alarm severity, or point type.

02. Alarm Notification shall be presented to each workstation in a tabular format application, and shall include the following information for each alarm point: name, value, alarm time & date, alarm status, priority, acknowledgement information, and alarm count. Each alarm point or priority shall have the ability to sound a discrete audible notification.
 03. Alarm Display shall have the ability to list & sort the alarms based on alarm status, point name, ascending or descending alarm time.
 04. Directly from the Alarm Display, the user shall have the ability to acknowledge, silence the alarm sound, print, or erase each alarm. The interface shall also have the option to inhibit the erasing of active acknowledged alarms, until they have returned to normal status. The user shall also have the ability to command, launch an associated graphic or trended graphical plot, or run a report on a selected alarm point directly on the Alarm Display.
 05. Each alarm point shall have a direct link from the Alarm Display to further user-defined point informational data. The user shall have the ability to also associate real-time electronic annotations or notes to each alarm.
 06. Alarm messages shall be customizable for each point, or each alarm priority level, to display detailed instructions to the user regarding actions to take in the event of an alarm. Alarm messages shall also have the optional ability to individually enunciate on the workstation display via a separate pop-up window, automatically being generated as the associated alarm condition occurs. The system shall have the ability to modify the priority text based on operator preference.
 07. Alarm Display application shall allow workstation operators to send and receive real-time messages to each other, for purposes of coordinating Alarm and HVAC Control System management.
- bb. Remote notification of messages
01. Operator Interface software shall be configured to send out messages to numeric pagers, alphanumeric pagers, phones (via text to speech technology), SMS (Simple Messaging Service, text messaging) Devices, and email accounts based on a point's alarm condition.
 02. There shall be no limit to the number of points that can be configured for remote notification of alarm conditions and no limit on the number of remote devices which can receive messages from the system.
 03. On a per point basis, system shall be configurable to send messages to an individual or group and shall be configurable to send different messages to different remote devices based on alarm message priority level.

04. Remote devices may be scheduled as to when they receive messages from the system to account for operators' work schedules.
05. System must be configurable to send messages to an escalation list so that if the first device does not respond, the message is sent on to the next device after a configurable time has elapsed.
06. Message detail shall be configurable on a per user basis.
07. During a "flood" of alarms, remote notification messages shall have the ability to optimize several alarms into an individual remote notification message.
08. Workstation shall have the ability to send manual messages allowing an operator to type in a message to be sent immediately.
09. Workstation shall have a feature to send a heartbeat message to periodically notify users that they have communication with the system.

D. WEB BASED OPERATOR INTERFACE

1. Operator shall be able to access the field panel embedded Web server remotely using MS Internet Explorer 6.0 or higher.
2. Internet connections, ISP services, as well as necessary firewalls or proxy servers shall be provided by the Grossmont Union High School District as required to support the web access feature.

2.12 BUILDING CONTROLLER SOFTWARE

A. General

1. Furnish the following applications software to form a complete operating system for building and energy management as described in this specification.
2. The software programs specified in this Section shall be provided as an integral part of Building Controllers and shall not be dependent upon any higher level computer or another controller for execution.
3. All points, panels and programs shall be identified by a 30 character name. All points shall also be identified by a 16 character point descriptor. The same names shall be displayed at both Building Controller and the Operator Interface.
4. All digital points shall have a user defined two-state status indication with 8 characters minimum (e.g. Summer, Enabled, Disabled, Abnormal).
5. Building Controllers shall have the ability to perform energy management routines including but not limited to time of day scheduling, calendar-based scheduling, holiday scheduling, temporary schedule overrides, start stop time optimization, automatic daylight savings time switch over, night setback control, enthalpy switch over, peak demand limiting, temperature-compensated duty cycling, heating / cooling interlock, supply temperature reset, priority load shedding, and power failure restart.

6. The Building Controllers shall have the ability to perform the following pre tested control algorithms:
 - a. Two position control
 - b. Proportional control
 - c. Proportional plus integral control
 - d. Proportional, integral, plus derivative control
 - e. Automatic tuning of control loops
 - f. Model-Free Adaptive Control
 7. Each controller shall be provided with an interactive HELP function to assist operators using POTs and remote connected operators.
- B. Web Based Operator Interface:
1. The HVAC Control System shall provide a Web based graphical interface that allows users to access the HVAC Control System data via the Internet, extranet, or Intranet (TCP/IP). The Web based graphical interface shall use HTML-based pages to send and receive data directly from a network of HVAC Control System Field Panels to a web browser. Dedicated PC-based Web servers or separate "Web Appliance" devices may be allowed for this purpose.
 2. The Web server shall allow monitor and control to any field panels networked together on the same automation level TCP/IP network.
 - a. The web server must provide a common alarm display that shows alarms in all field panels on the network.
 - b. The web server must be able to provide common graphics that simultaneously display the current value and status for points residing in multiple field panels.
 - c. The web server must be able to display daily mode schedules for points from multiple field panels simultaneously.
 3. The Web server shall support browser access via Microsoft Internet Explorer 6.0 (or later), with "cookies" enabled and compatible Microsoft Java Applet (JVM) installed.
 4. Access to the Web interface shall be username and password protected. A user's rights and privileges to database objects within the HVAC Control System shall be configurable on a per-user basis. An option shall exist to only allow users "read" access to HVAC Control System objects via the web browser. Operator sessions shall be configurable for "auto-logoff" after a designated period of user inactivity.
 5. The embedded Web server shall support an unlimited number of user accounts. Up to two concurrent user sessions shall be available for simultaneous operator access to the Web server's pages.
 6. The embedded Web server shall be compatible with and allow coexistence within standard IT security policies and tools (e.g., Firewall protection).

7. The embedded Web server shall provide the following functionality to users via Web browser, based on their access and privilege rights:
 - a. Logon Screen – allows the user to enter his user name and password for logging into the Web server.
 - b. Alarm Display – a display of current HVAC Control System alarms to which the user has access will be displayed. Users will be able to acknowledge active alarms, erase resolved alarms, and directly link to the Point Commanding feature.
 01. The alarm display must provide a filter that displays all alarms whether acknowledged or not.
 02. The alarm display must provide a filter that displays only alarms that have not yet been acknowledged.
 03. The alarm display must provide a persistent indication whenever there is one or more unacknowledged alarm in any connected field panel.
 - c. Graphic Display – Display of system graphics shall be available for viewing over the Web browser. A graphic selector list will allow users to select any graphics to which they have access. Graphic displays will automatically refresh with the latest change of values. Users will have the ability to command and override points directly from the graphic display as determined by their user accounts rights. The Graphic Display shall accommodate up to 10 customized graphics, plus any Application-specific graphics related to the Application Specific Controllers encompassed by the system.
 01. The web server must allow users to create at least one graphic online through the Web interface without requiring the use of external software programming tool.
 - d. Point details – users will have access to point detail information including operational status, operational priority, physical address, and alarm limits, for point objects to which they have access rights.
 - e. Point Commanding – users will be able to override and command points they have access to via the web browser interface.
 - f. Scheduling – shall allow operators, depending on their current user privileges, to override schedules selected by date, and to modify the properties of a selected schedule.
 01. The scheduler display must be able to represent facility mode schedules in a graphical format.
 - g. Point Status Report – allows users to run and print a pre-configured point log report through a web interface client that shows the point name, descriptor, command priority, alarm status, and current value. The report shall allow selection of individual points or wildcard selection of points.

- h. Trend Data Report – allows users to run and print a pre-configured trend data report for historical data reporting, including a representation of the alarm status of the each point for each Trend sample. The report shall allow selection of individual points or wildcard selection of points.
- i. Internet connections, ISP services, as well as necessary firewalls or proxy servers shall be provided by the Grossmont Union High School District as required to support the web access feature.

C. System Security

- 1. User access shall be secured using individual security passwords and user names.
- 2. Passwords shall restrict the user to the objects, applications, and system functions as assigned by the system manager.
- 3. User Log On / Log Off attempts shall be recorded.
- 4. The system shall protect itself from unauthorized use by automatically logging off following the last keystroke. The delay time shall be user-definable.
- 5. Use of workstation resident security as the only means of access control is not an acceptable alternative to resident system security in the field panel.

D. User Defined Control Applications

- 1. Controllers shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.
- 2. It shall be possible to use any system measured point data or status, any system calculated data, a result from any process, or any user-defined constant in any controller in the system.
- 3. Any process shall be able to issue commands to points in any and all other controllers in the system.
- 4. Processes shall be able to generate operator messages and advisories to other operator I/O devices. A process shall be able to directly send a message to a specified device or cause the execution of a dial-up connection to a remote device such as a printer or pager.
- 5. Each controller shall support plain language text comment lines in the operating program to allow for quick troubleshooting, documentation, and historical summaries of program development.
- 6. Controller shall provide a HELP function key, providing enhanced context sensitive on-line help with task oriented information from the user manual.

E. Alarm Management

1. Alarm management shall be provided to monitor and direct alarm information to operator devices. Each Building Controller shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic and prevent alarms from being lost. At no time shall the Building Controllers ability to report alarms be affected by either operator or activity at a PC workstation, local I/O device or communications with other panels on the network.
2. Conditional alarming shall allow generation of alarms based upon user defined multiple criteria.
3. An Alarm "shelving" feature shall be provided to disable alarms during testing. (Pull the Plug, etc.).
4. Binary Alarms. Each binary object shall be set to alarm based on the operator-specified state. Provide the capability to automatically and manually disable alarming.
5. Analog Alarms. Each analog object shall have both high and low alarm limits. Alarming must be able to be automatically and manually disabled.
6. All alarm or point change reports shall include the point's user defined language description and the time and date of occurrence.
7. The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of six priority levels shall be provided for each point. Point priority levels shall be combined with user definable destination categories (PC, printer, Building Controller, etc.) to provide full flexibility in defining the handling of system alarms. Each Building Controller shall automatically inhibit the reporting of selected alarms during system shutdown and start-up. Users shall have the ability to manually inhibit alarm reporting for each point.
8. Alarm reports and messages shall be routed to user-defined list of operator workstations, or other devices based on time and other conditions. An alarm shall be able to start programs, print, be logged in the event log, generate custom messages, and display graphics.
9. In addition to the point's descriptor and the time and date, the user shall be able to print, display or store a 200 character alarm message to more fully describe the alarm condition or direct operator response.
 - a. Each Building Controller shall be capable of storing a library of at least 50 alarm messages. Each message may be assignable to any number of points in the Controller.
10. Operator-selected alarms shall be capable of initiating a call to a remote operator device.

F. Scheduling

1. Provide a comprehensive menu driven program to automatically start and stop designated object or group of objects in the system according to a stored time.
 2. Schedules shall reside in the building controller and shall not rely on external processing or network.
 3. It shall be possible to define a group of objects as a custom event (i.e. meeting, athletic activity, etc.). Events can then be scheduled to operate all necessary equipment automatically.
 4. For points assigned to one common load group, it shall be possible to assign variable time delays between each successive start and/or stop within that group.
 5. The operator shall be able to define the following information:
 - a. Time, day
 - b. Commands such as on, off, auto, etc.
 - c. Time delays between successive commands.
 - d. There shall be provisions for manual overriding of each schedule by an authorized operator.
 6. It shall be possible to schedule calendar-based events up to one year in advance based on the following:
 - a. Weekly Schedule. Provide separate schedules for each day of the week. Each of these schedules should include the capability for start, stop, optimal start, optimal stop, and night economizer. When a group of objects are scheduled together as an Event, provide the capability to adjust the start and stop times for each member.
 - b. Exception Schedules. Provide the ability for the operator to designate any day of the year as an exception schedule. Exception schedules may be defined up to a year in advance. Once an exception schedule is executed, it will be discarded and replaced by the standard schedule for that day of the week.
 - c. Holiday Schedules. Provide the capability for the operator to define up to 99 special or holiday schedules. These schedules may be placed on the scheduling calendar and will be repeated each year. The operator shall be able to define the length of each holiday period.
- G. Automatic Daylight Savings Time Switchover: The system shall provide automatic time adjustment for switching to/from Daylight Savings Time.
- H. Night setback control. The system shall provide the ability to automatically adjust setpoints for night control.

- I. Enthalpy switchover (economizer). The Building Controller Software (BCS) shall control the position of the air handler relief, return, and outside air dampers. If the outside air dry bulb temperature falls below changeover set point the BCS will modulate the dampers to provide 100 percent outside air. The user will be able to quickly changeover to an economizer system based on dry bulb temperature and will be able to override the economizer cycle and return to minimum outside air operation at any time.
- J. Loop Control. A Model-Free Adaptive Control algorithm or alternatively a PID (proportional-integral-derivative) closed-loop control algorithm with direct or reverse action and anti-windup shall be supplied. The algorithm shall calculate a time-varying analog value that is used to position an output or stage a series of outputs. The controlled variable, set point, and weighting parameters shall be user-selectable.
- K. Sequencing. Provide application software based upon the sequences of operation specified to properly sequence equipment.
- L. Staggered Start
 - 1. This application shall prevent all controlled equipment from simultaneously restarting after a power outage. The order in which equipment (or groups of equipment) is started, along with the time delay between starts, shall be user definable.
 - 2. Upon the resumption of power, each Building Controller shall analyze the status of all controlled equipment, compare it with normal occupancy scheduling and turn equipment on or off as necessary to resume normal operations.
- M. Totalization
 - 1. Run-Time Totalization. Building Controllers shall automatically accumulate and store run-time hours for all digital input and output points. A high runtime alarm shall be assigned, if required, by the operator.
 - 2. Consumption totalization. Building Controllers shall automatically sample, calculate and store consumption totals on a daily, weekly or monthly basis for all analog and digital pulse input type points.
 - 3. Event totalization. Building Controllers shall have the ability to count events such as the number of times a pump or fan system is cycled on and off. Event totalization shall be performed on a daily, weekly or monthly basis for all points. The event totalization feature shall be able to store the records associated with events before reset.
- N. Data Collection
 - 1. A variety of historical data collection utilities shall be provided to manually or automatically sample, store, and display system data for all points.
 - 2. Building Controllers shall store point history data for selected analog and digital inputs and outputs:
 - a. Any point, physical or calculated may be designated for trending. Any point, regardless of physical location in the network, may be collected and stored in each Building Controllers point group.

3. Trend data shall be stored at the Building Controllers and uploaded to the workstation when retrieval is desired. Uploads shall occur based upon either user-defined interval, manual command or when the trend buffers are full. All trend data shall be available for use in 3rd party personal computer applications.
4. Loop Tuning. Building Controllers shall also provide high resolution sampling capability for verification of DDC control loop performance. Documented evidence of tuned control loop performance shall be provided on a <monthly, seasonal, quarterly, annual> period.
 - a. For Model-Free Adaptive Control loops, evidence of tuned control loop performance shall be provided via graphical plots or trended data logs. Graphical plots shall minimally include depictions of setpoint, process variable (output), and control variable (e.g., temperature). Other parameters that may influence loop control shall also be included in the plot (e.g., fan on/off, mixed-air temp).
 - b. For PID control loops, operator-initiated automatic and manual loop tuning algorithms shall be provided for all operator-selected PID control loops. Evidence of tuned control loop performance shall be provided via graphical plots or trended data logs for all loops.
 01. In automatic mode, the controller shall perform a step response test with a minimum one-second resolution, evaluate the trend data, calculate the new PID gains and input these values into the selected LOOP statement.
 02. Loop tuning shall be capable of being initiated either locally at the Building Controller, from a network workstation or remotely using dial-in modems. For all loop tuning functions, access shall be limited to authorized personnel through password protection.

2.13 BUILDING CONTROLLERS

- A. Building Controllers shall be 32 bit, multi-tasking, multi-user, real-time 48 MHz digital control processors consisting of modular hardware with plug-in enclosed processors, communication controllers, power supplies and input/output point modules. Controller size shall be sufficient to fully meet the requirements of this specification and the attached point list.
- B. Each Building Controller shall support a minimum of 3 directly connected Floor Level Networks.
- C. Each Building Controller shall have sufficient memory, a minimum of 72 megabyte, to support its own operating system and databases, including control processes, energy management applications, alarm management applications, historical/trend data for points specified, maintenance support applications, custom processes, operator I/O, and dial-up communications.
- D. Building Controller shall have an integral real-time clock.
- E. Each Building Controller shall support firmware upgrades without the need to change hardware.

- F. Each Building Controller shall support:
 - 1. Monitoring of industry standard analog and digital inputs, without the addition of equipment outside the Building Controller cabinet.
 - 2. Monitoring of industry standard analog and digital outputs, without the addition of equipment outside the Building Controller cabinet.
- G. Serial Communication. Building Controllers shall provide at least two EIA-232C serial data communication ports for operation of operator I/O devices such as industry standard printers, operator terminals, and portable laptop operator's terminals. Building Controllers shall allow temporary use of portable devices without interrupting the normal operation of permanently connected printers or terminals.
- H. I/O Status and Indication. Building Controllers shall provide local LED status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device. Graduated intensity LEDs or analog indication of value shall also be provided for each analog output. All wiring connections shall be made to field-removable terminals.
- I. Self Diagnostics. Each Building Controller shall continuously perform self diagnostics, communication diagnosis, and diagnosis of all panel components. The Building Controller shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication for any system.
- J. Power loss. In the event of the loss of power, there shall be an orderly shutdown of all Building Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 100 hours.
- K. Environment.
 - 1. Controller hardware shall be suitable for the anticipated ambient conditions.
 - 2. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures and shall be rated for operation at 0°C to 49°C (32°F to 120°F).
 - 3. Controllers used in conditioned space shall be mounted in dust-proof enclosures and shall be rated for operation at 0°C to 49°C (32°F to 120°F).
- L. Immunity to power and noise.
 - 1. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage.
 - a. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m (3 ft).
 - 2. Isolation shall be provided at all primary network terminations, as well as all field point terminations to suppress induced voltage transients consistent with:
 - a. RF-Conducted Immunity (RFCI) per ENV 50141 (IEC 1000-4-6) at 3 V

- b. Electro Static Discharge (ESD) Immunity per EN 61000-4-2 (IEC 1000-4-2) at 8 kV air discharge, 4 kV contact
 - c. Electrical Fast Transient (EFT) per EN 61000-4-4 (IEC 1000-4-4) at 500 V signal, 1 kV power
 - d. Output Circuit Transients per UL 864 (2,400V, 10A, 1.2 Joule max)
- 3. Isolation shall be provided at all Building Controller's AC input terminals to suppress induced voltage transients consistent with:
 - a. IEEE Standard 587 1980
 - b. UL 864 Supply Line Transients
 - c. Voltage Sags, Surge, and Dropout per EN 61000-4-11 (EN 1000-4-11)
- M. Minimum Approved Building Controllers.
 - 1. HVAC Control Contractor/Manufacture shall furnish Building Controllers as listed below. Providing an approved controller does not release the contractor from meeting all performance, software and hardware specifications for Building Controllers and system operations.
 - 2. Modular Building/Equipment Controllers (MBC/MEC).

2.14 APPLICATION SPECIFIC CONTROLLERS (ASC)

A. General

- 1. Provide for control of each piece of equipment, including, but not limited to the following:
 - a. Rooftop Packaged AC Units
 - b. Split System AC Units
 - c. Existing HVAC units as noted in the mechanical schedule.
- 2. Each Building Controller shall be able to communicate with application specific controllers (ASCs) over the Floor Level Network to control terminal equipment only.
- 3. The use of Floor Level Network controllers with custom program applications to control AHU's, water systems, etc. is not acceptable.
- 4. Each ASC shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC shall be a microprocessor-based, multi-tasking, real-time digital control processor.
- 5. Each ASC shall include all point inputs and outputs necessary to perform the specified control sequences. The ASC shall accept input and provide output signals that comply with industry standards. Controllers utilizing proprietary control signals shall not be acceptable. Outputs utilized either for two-state, modulating floating, or proportional control, allowing for additional system flexibility.

6. Space Temperature Sensors. Each controller performing space temperature control shall be provided with a matching room temperature sensor.
 - a. Wired Sensor specifications. The sensor may be either RTD or thermistor type providing the following.
 01. Accuracy: + .5 F
 02. Operating Range: 35 to 115 F
 03. Set Point Adjustment Range: 55 to 95 F
 04. Calibration Adjustments: None required
 05. Installation: Up to 100 ft. from controller
 06. Auxiliary Communications Port:: as required
 07. Local LCD Temperature Display: as required
 08. Set Point Adjustment Dial: as required
 09. Occupancy Override Switch: as required
 - b. Set Point Modes:
 01. Independent Heating, Cooling
 02. Night Setback-Heating
 03. Night Setback-Cooling
 - c. Auxiliary Communication Port. Each room temperature sensor shall include a terminal jack integral to the sensor assembly. The terminal jack shall be used to connect a portable operator's terminal to control and monitor all hardware and software points associated with the controller. RS-232 communications port shall allow the operator to query and modify operating parameters of the local room terminal unit from the portable operator's terminal.
 - d. LCD Display. Interactive, two- line liquid crystal display shall allow the operator to query and modify operating parameters of the local room terminal unit from the room sensor. The display shall indicate the space temperature and associated ASC point when not being used to query or modify operating parameters.
 - e. Set Point Adjustment Dial. The set point adjustment dial shall allow for modification of the temperature by the building operators. Set point adjustment may be locked out, overridden, or limited as to time or temperature through software by an authorized operator at any central workstation, Building Controller, room sensor two-line display, or via the portable operator's terminal.
 - f. Override Switch. An override switch shall initiate override of the night setback mode to normal (day) operation when activated by the occupant and enabled by building operators. The override shall be limited to two (2) hours (adjustable.) The override function may be locked out, overridden, or limited through software by an authorized operator at the operator interface, Building Controller, room sensor two-line display or via the portable operator's terminal.
7. Communication. Each controller shall perform its primary control function independent of other Floor Level Network communication, or if Floor Level Network communication is interrupted. Reversion to a fail-safe mode of operation during Floor Level Network interruption is not acceptable.

8. Control Algorithms. The controller shall receive its real-time data from the Building Controller time clock to insure Floor Level Network continuity. Each controller shall include algorithms incorporating proportional, integral and derivative (PID) gains for all applications. All PID gains and biases shall be field-adjustable by the user via room sensor LCD or the portable operator's terminal as specified herein. Controllers that incorporate proportional and integral (PI) control algorithms only shall not be acceptable.
9. Control Applications. Operating programs shall be field-selectable for specific applications. In addition, specific applications may be modified to meet the user's exact control strategy requirements, allowing for additional system flexibility. Controllers that require factory changes of all applications are not acceptable.
10. Calibration. Each controller shall include provisions for manual and automatic calibration of the differential pressure transducer in order to maintain stable control and insuring against drift over time.
 - a. Manual calibration may be accomplished by either commanding the actuator to 0% via the POT or by depressing the room sensor override switch. Calibration of the transducer at the controller location shall not be necessary.
 - b. Calibration shall be accomplished by stroking the terminal unit damper actuator to a 0% position so that a 0 CFM air volume reading is sensed. The controller shall automatically accomplish this whenever the system mode switches from occupied to unoccupied or vice versa.
 - c. Calibration shall be accomplished by zeroing out the pressure sensor and holding damper at last known position until calibration is complete. The controller shall automatically accomplish this whenever the system mode switches from occupied to unoccupied or vice versa.
11. Memory.
 - a. Provide each ASC with sufficient memory to accommodate point databases, operating programs, local alarming and local trending. All databases and programs shall be stored in non-volatile EEPROM, EPROM and PROM, or minimum of 72-hour battery backup shall be provided. The controllers shall be able to return to full normal operation without user intervention after a power failure of unlimited duration.
 - b. Upon replacement, new ASCs shall recover control function and site specific defaults automatically and resume normal operation.
12. Power Supply. The ASCs shall be powered from a 24 VAC source and shall function normally under an operating range of 18 to 28 VAC, allowing for power source fluctuations and voltage drops. Power supply for the ASC must be rated at a minimum of 125% of ASC power consumption and shall be of the fused or current limiting type. The HVAC Control System contractor shall provide 24 VAC power to the terminal units by utilizing:
 - a. The existing line voltage power trunk and installing separate isolation transformers for each controller
 - b. Dedicated line voltage power source and isolation transformers at a central location and installing 24VAC power trunk to supply multiple ASCs in the area.

13. Environment. The controllers shall function normally under ambient conditions of 32 to 122 F (0 to 50 C) and 10% to 95%RH (non-condensing). Provide each controller with a suitable cover or enclosure to protect the circuit board assembly.
14. Immunity to noise. Operation shall be protected against electrical noise of 5-120 Hz and from keyed radios up to 5 W at 1 m (3 ft).

2.15 INPUT/OUTPUT INTERFACE:

- A. Hardwired inputs and outputs may tie into the system through building or application specific controllers.
- B. All input points and output points shall be protected such that shorting of the point to itself, to another point, or to ground will cause no damage to the controller. All input and output points shall be protected from voltage up to 24 V of any duration, such that contact with this voltage will cause no damage to the controller.
- C. Binary inputs shall allow the monitoring of On/Off signals from remote devices. The binary inputs shall provide a wetting current of at least 12 mA to be compatible with commonly available control devices and shall be protected against the effects of contact bounce and noise. Binary inputs shall sense "dry contact" closure without external power (other than that provided by the controller) being applied.
- D. Pulse accumulation input objects. This type of object shall conform to all the requirements of binary input objects and also accept up to 10 pulses per second for pulse accumulation.
- E. Analog inputs shall allow the monitoring of low-voltage (0 to 10 VDC), current (4 to 20 mA), or resistance signals (thermistor, RTD). Analog inputs shall be compatible with—and field configurable to—commonly available sensing devices.
- F. Binary outputs shall provide for On/Off operation or a pulsed low-voltage signal for pulse width modulation control. Binary outputs on building and custom application controllers shall have three-position (On/Off/Auto) override switches and status lights. Outputs shall be selectable for either normally open or normally closed operation.
- G. Analog outputs shall provide a modulating signal for the control of end devices. Outputs shall provide either a 0 to 10 VDC, 4 to 20 mA or 0-20 PSI signal as required to provide proper control of the output device. Analog outputs on building or custom application controllers shall have status lights and a two-position (AUTO/MANUAL) switch and manually adjustable potentiometer for manual override. Analog outputs shall not exhibit a drift of greater than 0.4% of range per year.
- H. Tri-State Outputs. Provide tri-state outputs (two coordinated binary outputs) for control of three-point floating type electronic actuators without feedback. Use of three-point floating devices shall be limited to zone control and terminal unit control applications (VAV terminal units, duct-mounted heating coils, zone dampers, radiation, etc.). Control algorithms shall run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.
- I. System Object Capacity. The system size shall be expandable to at least twice the number of input/ output objects required for this project. Additional controllers (along with associated devices and wiring) shall be all that is necessary to achieve this capacity requirement. The operator interfaces installed for this project shall not require any hardware additions or software revisions in order to expand the system.

2.16 POWER SUPPLIES AND LINE FILTERING

- A. Control transformers shall be UL listed. Furnish Class 2 current-limiting type or furnish over-current protection in both primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.
- B. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current protection and shall be able to withstand a 150% current overload for at least three seconds without trip-out or failure.
 - 1. Unit shall operate between 0°C and 50°C (32°F and 120°F). EM/RF shall meet FCC Class B and VDE 0871 for Class B and MILSTD 810C for shock and vibration.
 - 2. Line voltage units shall be UL recognized and CSA approved.
- C. Power line filtering.
 - 1. Provide transient voltage and surge suppression for all workstations and WEB controllers either internally or as an external component. Surge protection shall have the following at a minimum:
 - a. Dielectric strength of 1000 volts minimum
 - b. Response time of 10 nanoseconds or less
 - c. Transverse mode noise attenuation of 65 dB or greater
 - d. Common mode noise attenuation of 150 dB or better at 40 Hz to 100 Hz.

2.17 AUXILIARY CONTROL DEVICES

- A. General
 - 1. Specified in this section are the following hard wired input/output devices connected to the Building Controller or ASC.
 - a. Binary Temperature Devices
 - b. Temperature Sensors
 - c. Dew Point/Humidity Sensors
 - d. Indoor Air Quality (CO2/VOC) Space Sensors
 - e. Relays
 - f. Current Switches

B. Binary temperature devices.

1. Line-voltage space thermostat:
 - a. Line-voltage thermostats shall be bimetal-actuated, snap acting SPDT contact, enclosed, UL listed for electrical rating. The thermostat cover shall provide exposed set point adjustment knob. The thermostat shall operate within the 55°F to 85°F setpoint range, with 2°F maximum differential.
2. Low-temperature safety thermostat:
 - a. Low-limit air stream thermostats shall be UL listed, vapor pressure type, with a sensing element of 20 ft. minimum length. Element shall respond to the lowest temperature sensed by any 1 ft. section. The low-limit thermostat shall be automatic reset, SPDT type.

C. Temperature sensors.

1. Provide the following instrumentation as required by the monitoring, control and optimization functions. All temperature sensor shall use platinum RTD elements only, nickel or silicon are not acceptable. All control signals shall be via a 4-20 mA loop.
2. Room Temperature:
 - a. Temperature monitoring range: +40/+90 F (+40/120 F for high temp alarms)
 - b. Installation adjustments: none required
 - c. Factory calibration point: 70 deg F
 - d. Accuracy at calibration point: +0.5 F
3. Outside Air Temperature
 - a. Temperature monitoring range: -50/+122
 - b. Output signal: 4-20 mA
 - c. Installation adjustments: none required
 - d. Calibration adjustments: zero & span
 - e. Factory calibration point: 70 deg F
 - f. Accuracy at calibration point: +0.5 F

D. Dew point/humidity sensors

1. Outside Air Dew Point Temperature
 - a. Dew point monitoring range: -40/+115 F DP, 12% to 99% RH
 - b. Output signal: 4-20 mA
 - c. Calibration adjustments: zero & span
 - d. Factory calibration point: 70 F
 - e. Accuracy at calibration point: +2.0 Fdp

2. Room/duct Relative Humidity
 - a. Sensor Humidity range: 0 to 100%
 - b. Operating temperature: 15 F to +170 F
 - c. Accuracy: +2% RH
 - d. Sensing element: Capacitive sensor
 - e. Output signal: 4-20 mA DC
 - f. Installation adjustments: zero & span
 - g. Operating temperature: 15 F to +170 F
 - h. Voltage requirement: 12-36 VDC

E. Indoor air quality (CO₂/VOC) sensors

1. Provide indoor air quality sensors to monitor Carbon Dioxide (CO₂)
2. The units shall be wall or duct mounted type as indicated on plans and in the sequence of operation.
3. Wall mounted sensors shall be provided with white plastic cover, without LED indicators.
4. Duct mounted sensors shall be provided with LED indicators in a dust proof plastic housing with transparent cover.
5. The sensor shall meet the following requirements:
 - a. Operating voltage: 24 VAC +/- 20%
 - b. Frequency: 50/60 Hz
 - c. Power consumption: max. 1 Watt
 - d. CO₂ measuring range: 0 – 2000 ppm
 - e. Tolerance: +/- 30 ppm +3% of measured value
 - f. Output: 0 – 10 VAC
 - g. Calibration: none required
 - h. Permissible air velocity in duct: <26.2 Ft/s.
6. The sensors shall be model:
 - a. Honeywell – C7262A1016.

F. Relays

1. Control relays shall be UL listed plug-in type with dust cover and LED "energized" indicator. Contact rating, configuration, and coil voltage shall be suitable for application.

G. Current switches

1. Current-operated switches shall be self-powered, solid-state with adjustable trip current. The switches shall be selected to match the current of the application and output requirements of the DDC system.

2.18 COMMUNICATION AND CONTROL WIRING

A. General:

1. Provide copper wiring, plenum cable, and raceways as specified in the applicable sections of Division 26 unless otherwise noted herein.

2. All insulated wire to be copper conductors, UL labeled for 90°C minimum service.

B. Wire Sizing and Insulation

1. Wiring shall comply with minimum wire size and insulation based on services listed below:

	<u>Service</u>	<u>Minimum Gage/Type</u>	<u>Insulation Class</u>
a.	Class 1	14 Ga Stranded	600 Volt
b.	Class 2	18 Ga Stranded	300 Volt
c.	Class 3	18 Ga Stranded	300 Volt

2. Provide plenum-rated cable when open cable is permitted in supply or return air plenum where allowed per execution specifications defined in Paragraph 3.07

C. Control Wiring:

1. Digital Input/Output wiring shall use Class 2 twisted pair, insulated.
2. Analog inputs shall use Class 2 twisted pair, insulated and shielded where required.
3. Actuators with tri-state control shall use 3 conductor with same characteristics

D. Communication Wiring

1. MLN Ethernet Cable shall be minimum CAT5
2. BLN and FLN shall be 24 gage, TSP, low capacitance cable.

E. Approved Cable Manufacturers:

1. Wiring from the following manufacturers which meet the above criteria shall be acceptable:
 - a. Anixter
 - b. Belden

2.19 FIBER OPTIC CABLE SYSTEM

- A. Fiber Optic cable: Optical cables shall be duplex 900 mm tight-buffer construction designed for intra-building environments. The sheath shall be UL Listed OFNP in accordance with NEC Article 770. The optical fiber shall meet the requirements of FDDI, ANSI X3T9.5 PMD for 62.5/125mm for use in 10/100 MB fiber optic networks.
- B. Connectors: All optical fibers shall be field-terminated with ST type connectors. Connectors shall have hot melt and polish or epoxy and polish type connectors. No Mechanical crimp type permitted.
- C. Outdoor/underground installation of Fiber Optic cable shall be gel coated and rated for outdoor/underground installation
- D. Four strands is the minimum required for each run, two for the link and two as spares.
- E. 1 GB Ethernet networks shall be single mode fiber for lengths over 275m. Single mode Ethernet requires two strands of 9 um cable

PART 3 – EXECUTION

3.01 EXAMINATION:

- A. The project plans shall be thoroughly examined for control device and equipment locations. Any discrepancies, conflicts, or omissions shall be reported to the architect/engineer for resolution before rough-in work is started.
- B. The contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the engineer for resolution before rough-in work is started.
- C. The contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate—or if any discrepancies occur between the plans and the contractor's work and the plans and the work of others—the contractor shall report these discrepancies to the engineer and shall obtain written instructions for any changes necessary to accommodate the contractor's work with the work of others.

3.02 PROTECTION

- A. The contractor shall protect all work and material from damage by its employees and/or subcontractors and shall be liable for all damage thus caused.
- B. The contractor shall be responsible for its work and equipment until finally inspected, tested, and accepted.

3.03 COORDINATION

- A. Site
 - 1. The controls contractor shall follow prime contractor's job schedule and coordinate all project related activities through the prime contractor except otherwise agreed or in minor job site issues. Reasonable judgment shall be applied.
 - 2. Where the work will be installed in close proximity to, or will interfere with, work of other trades, the contractor shall assist in working out space conditions to make a satisfactory adjustment.
 - 3. If the contractor deviates from the job schedule and installs work without coordinating with other trades, so as to cause interference with work of other trades, the contractor shall make the necessary changes to correct the condition without extra charge.
 - 4. Coordinate and schedule work with all other work in the same area, or with work that is dependent upon other work, to facilitate mutual progress.
- B. Test and Balance
 - 1. The contractor shall furnish any necessary software to the test and balance contractor for interface to the control system for test and balance purposes.
 - 2. The contractor shall provide training in the use of this software up to a total of two (2) hours.

3. In addition, the contractor shall provide a qualified technician for duration of two (2) hours to assist in the test and balance process.
 4. Any proprietary software used during the test and balance process shall be returned at the completion of the testing and balancing work to the contractor.
- C. Coordination with controls specified in other sections or divisions.
1. Other sections and/or divisions of this specification include controls and control devices that are to be part of or interfaced to the control system specified in this section. These controls shall be integrated into the system and coordinated by the contractor as follows:
 - a. All communication media and equipment shall be provided as specified in Part 2, "Communication" of this specification. Campus ethernet network between buildings including all associated hardware and software, configuration and commissioning is not part of the HVAC Control System work.
 - b. Each supplier of controls product is responsible for the configuration, programming, startup, and testing of that product to meet the sequences of operation described in this section.
 - c. The Contractor shall coordinate and resolve any incompatibility issues that arise between the control products provided under this section and those provided under other sections or divisions of this specification.

3.04 GENERAL WORKMANSHIP

- A. Install equipment, piping, and wiring/raceway parallel to building lines (i.e., horizontal, vertical, and parallel to walls) wherever possible.
- B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
- C. Install all equipment in readily accessible locations as defined by Chapter 1, Article 100, Part A of the National Electrical Code (NEC).
- D. Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.
- E. All equipment, installation, and wiring shall comply with acceptable industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices.

3.05 FIELD QUALITY CONTROL

- A. Contractor shall have a certified project manager on staff to inspect the project execution and to enforce quality standards.
- B. All work, materials, and equipment shall comply with the rules and regulations of applicable local, state, and federal codes and ordinances as identified in Part 1 of this specification.
- C. Contractor shall continually monitor the field installation for code compliance and quality of workmanship.

- D. Contractor shall have work inspected by local and/or state authorities having jurisdiction over the work, as required.

3.06 EXISTING EQUIPMENT

- A. Unless otherwise directed, the contractor is not responsible for the repairs or replacement of existing energy equipment and systems, valves, dampers, or actuators.
- B. Should the contractor find existing equipment that requires maintenance, the GUHSD Representative is to be notified immediately.

3.07 WIRING

- A. All control and interlock wiring shall comply with national and local electrical codes and Division 26 of this specification. Where the requirements of this section differ from those in Division 26, the requirements of this section shall take precedence.
- B. All NEC Class 1 (line voltage) wiring shall be UL Listed in approved conduit according to NEC and Division 26 requirements.
- C. All low-voltage wiring shall meet NEC Class 2 requirements. (Low-voltage power circuits shall be sub fused when required to meet Class 2 current limit.)
- D. Where NEC Class 2 (current-limited) wires are in concealed and accessible locations, including ceiling return air plenums, approved cables not in conduit may be used provided that cables are UL Listed for the intended application. For example, cables used in ceiling plenums shall be UL Listed specifically for that purpose.
- E. All wiring in mechanical, electrical, or service rooms—or where subject to mechanical damage— shall be installed in conduit.
- F. Do not install Class 2 wiring in conduit containing Class 1 wiring. Boxes and panels containing high voltage wiring and equipment may not be used for low-voltage wiring except for the purpose of interfacing the two (e.g., relays and transformers).
- G. Do not install wiring in conduit containing tubing.
- H. Where plenum rated cable is run exposed, wiring is to be run parallel along a surface or perpendicular to it and neatly tied at 3 m (10 ft) intervals.
- I. Where plenum rated cable is used without conduit, it shall be supported from or anchored to structural members. Cables shall not be supported by or anchored to electrical conduits, piping, or ceiling suspension systems.
- J. All wire-to-device connections shall be made at a terminal block or wire nut. All wire-to-wire connections shall be at a terminal strip or wire nut.
- K. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.
- L. Maximum allowable voltage for control wiring shall be 120 V. If only higher voltages are available, the contractor shall provide step-down transformers or interposing relays.
- M. All plenum rated wiring shall be installed as continuous lengths, with no splices permitted between termination points.
- N. All wiring in conduit shall be installed as continuous lengths, with no splices permitted between termination points or junction boxes.

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- O. Maintain fire rating at all penetrations. Install plenum wiring in sleeves where it passes through walls and floors.
- P. Size and type of conduit and size and type of wire shall be the responsibility of the contractor, in keeping with the manufacturer's recommendations and NEC requirements, except as noted elsewhere.
- Q. Control and status relays are to be located in designated enclosures only. These enclosures can include packaged equipment control panel enclosures.
- R. Conceal all conduit, except within mechanical, electrical, or service rooms. Install conduit to maintain a minimum clearance of 15 cm (6 in.) from high-temperature equipment (e.g., steam pipes or flues).
- S. Secure conduit with conduit clamps fastened to the structure and spaced according to code requirements. Conduit and pull boxes may not be hung on flexible duct strap or tie rods. Conduits may not be run on or attached to ductwork.
- T. Adhere to this specification's Division 26 requirements where conduit crosses building expansion joints.
- U. The Contractor shall terminate all control and/or interlock wiring and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site.
- V. Flexible metal conduits and liquid-tight, flexible metal conduits shall not exceed 1 m (3 ft) in length and shall be supported at each end. Flexible metal conduit less than ½ in. electrical trade size shall not be used. In areas exposed to moisture, including chiller and boiler rooms, liquid-tight, flexible metal conduits shall be used.
- W. Conduit must be adequately supported, properly reamed at both ends, and left clean and free of obstructions. Conduit sections shall be joined with couplings (according to code). Terminations must be made with fittings at boxes, and ends not terminating in boxes shall have bushings installed.

3.08 COMMUNICATION WIRING

- A. The contractor shall adhere to the items listed in the "Wiring" article in Part 3 of the specification.
- B. All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer's installation recommendations for all communication cabling.
- C. Do not install communication wiring in raceway and enclosures containing Class 1.
- D. Maximum pulling, tension, and bend radius for cable installation, as specified by the cable manufacturer, shall not be exceeded during installation.
- E. Contractor shall verify the integrity of the entire network following the cable installation. Use appropriate test measures for each particular cable.
- F. When a cable enters or exits a building, a lightning arrestor must be installed between the lines and ground. The lightning arrestor shall be installed according to the manufacturer's instructions.
- G. All runs of communication wiring shall be unspliced length when that length is commercially available.

- H. All communication wiring shall be labeled in accordance with the HVAC Control System control drawing submittal package instructions or to indicate origination and destination data at a minimum.
- I. Grounding of coaxial cable shall be in accordance with NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."

3.09 INSTALLATION OF SENSORS

A. General:

- 1. Install sensors in accordance with the manufacturer's recommendations.
- 2. Mount sensors rigidly and adequately for the environment within which the sensor operates.
- 3. Room temperature sensors shall be installed on concealed junction boxes properly supported by the wall framing.
- 4. All wires attached to sensors shall be air sealed in their raceways or in the wall to stop air transmitted from other areas affecting sensor readings.
- 5. Sensors used in mixing plenums and hot and cold decks shall be of the averaging type.
- 6. Low-limit sensors used in mixing plenums shall be installed in a serpentine manner horizontally across the full face of the coil.
- 7. All pipe-mounted temperature sensors shall be installed in wells. Install all liquid temperature sensors with heat-conducting fluid in thermal wells.
- 8. Install outdoor air temperature sensors on north wall, complete with sun shield at designated location.

B. Room Instrument Mounting

- 1. Room instruments, including but not limited to wall mounted thermostats and sensors located in occupied spaces shall be mounted as shown on the mechanical plans.

C. Instrumentation Installed in Piping Systems

- 1. Thermometers and temperature sensing elements installed in liquid systems shall be installed in thermowells.
- 2. Gauges for steam service shall have pigtail fittings with isolation valve.

D. Temperature Limit Switch

- 1. A temperature limit switch (Low Temperature Detector) shall be provided to sense the temperature.
- 2. A sufficient number of temperature limit switches shall be installed to provide complete coverage of the duct section.
- 3. Manual reset limit switches shall be installed in approved, accessible locations where they can be reset easily.

4. The temperature limit switch sensing element shall be installed in a serpentine pattern and in accordance with the manufacturer's installation instructions.
5. Each bend shall be supported with a capillary clip. Provide 3 m of sensing element for each 1 m² (1 ft of sensing element for each 1 ft²) of coil area.

E. Relative Humidity Sensors

1. Relative humidity sensors in supply air ducts shall be installed at least 3m (10 feet) downstream of humidity injection elements.

3.10 WARNING LABELS AND IDENTIFICATION TAGS

A. Permanent warning labels shall be affixed to all equipment that can be automatically started by the DDC system.

1. Labels shall use white lettering (12-point type or larger) on a red background.
2. Warning labels shall read as follows: "C A U T I O N This equipment is operating under automatic control and may start or stop at any time without warning. Switch disconnect to "Off" position before servicing."

B. Permanent warning labels shall be affixed to all motor starters and all control panels that are connected to multiple power sources utilizing separate disconnects.

1. Labels shall use white lettering (12-point type or larger) on a red background.
2. Warning labels shall read as follows: "C A U T I O N This equipment is fed from more than one power source with separate disconnects. Disconnect all power sources before servicing."

C. Equipment and Device labeling:

1. Labels and tags shall be keyed to the unique identifiers shown on the As-Built drawings.
2. All Enclosures and DDC Hardware shall be labeled.
3. All sensors and actuators not in occupied areas shall be tagged.
4. Airflow measurement arrays shall be tagged to show flow rate range for signal output range, duct size, and pitot tube AFMS flow coefficient.
5. Duct static pressure taps shall be tagged at the location of the pressure tap.
6. Tags shall be plastic or metal and shall be mechanically attached directly to each device or attached by a metal chain or wire.
7. Labels exterior to protective enclosures shall be engraved plastic and mechanically attached to the enclosure or DDC Hardware.
8. Labels inside protective enclosures may be attached using adhesive, but shall not be hand written.
9. Identify all other control components with permanent labels. All plug-in components shall be labeled such that removal of the component does not remove the label.

10. Identify room sensors relating to terminal box or valves with nameplates.
11. Manufacturers' nameplates and UL or CSA labels are to be visible and legible after equipment is installed.

D. Identification of Tubing and Wiring

1. All wiring and cabling including that within factory-fabricated panels shall be labeled at each end within 5 cm (2 in.) of termination with the DDC address or termination number.
2. Permanently label or code each point of field terminal strips to show the instrument or item served.
3. All pneumatic tubing shall be labeled at each end within 5 cm (2 in.) of termination with a descriptive identifier.

3.11 IDENTIFICATION OF HARDWARE AND WIRING

- A. All wiring and cabling, including that within factory-fabricated panels shall be labeled at each end within 5 cm (2 in.) of termination with the DDC address or system point name.
- B. All pneumatic tubing shall be labeled at each end within 5 cm (2 in.) of termination with a descriptive identifier.
- C. Identify control panels with minimum 1 cm (½ in.) letters on laminated plastic nameplates.
- D. Manufacturers' nameplates and UL or CSA labels are to be visible and legible after equipment is installed.
- E. Identifiers shall match record documents.

3.12 PROGRAMMING

- A. Provide sufficient internal memory for the specified sequences of operation and trend logging. There shall be a minimum of 25% of available memory free within the primary controller for future use.
- B. Point Naming: System point names shall be modular in design, allowing easy operator interface without the use of a written point index. Point Naming standard shall be agreed upon between Grossmont Union High School District and HVAC Control Contractor/Manufacture. Refer to Submittals section in the General Section.

C. Software Programming

1. Provide programming for the system and adhere to the sequences of operation provided. The contractor also shall provide all other system programming necessary for the operation of the system, but not specified in this document. Imbed into the control program sufficient comment statements to clearly describe each section of the program. The comment statements shall reflect the language used in the sequences of operation and be of different font and color in text editor. Use the appropriate technique based on one of the following programming types:
 - a. Text-based:
 01. Must provide actions for all possible situations
 02. Must be modular and structured
 03. Must be commented
 04. Must provide line by line programming and compilation wizard to allow for ease of editing.
 - b. Graphic-based:
 01. Must provide actions for all possible situations
 02. Must provide programming and compilation wizard to allow for ease of editing.
 03. Must be documented

D. Operator Interface

1. Standard graphics—Provide graphics for all mechanical systems and floor plans of the building. This includes each chilled water system, hot water system, chiller, boiler, air handler, and all terminal equipment. Point information on the graphic displays shall dynamically update. Show on each graphic all input and output points for the system. Also show relevant calculated points such as set points.
2. The contractor shall provide all the labor necessary to install, initialize, start up, and troubleshoot all operator interface software and its functions as described in this section. This includes any operating system software, the operator interface database, and any third-party software installation and integration required for successful operation of the operator interface.
3. Contractor shall provide necessary programming to create all reports referred to in Part 2 Operator Interface Software

3.13 CONTROL SYSTEM CHECKOUT AND TESTING

- A. Perform commissioning procedures consisting of field I/O points, system commissioning and integrated system program commissioning. Document all commissioning information on commissioning data sheets that shall be submitted prior to acceptance testing. Commissioning work that requires shutdown of system or deviation from normal function shall be performed when the operation of the system is not required. The commissioning must be coordinated with the Grossmont Union High School District and construction manager to ensure systems are available when needed. Notify the operating personal in writing of the testing schedule so that authorized personnel from the Grossmont Union High School District and construction manager are present throughout the commissioning procedure.
- B. Phase I - Field I/O Commissioning
 - 1. Verify that each control panel has been installed according to plans, specifications and approved shop drawings. Test each control sensor and device. Commissioning to include, but not be limited to:
 - a. Verify analog limit and binary alarm reporting.
 - b. Point value reporting.
 - c. Binary alarm and switch settings.
 - d. Actuator and positioner spring ranges if pneumatic actuation is utilized.
 - e. Fail safe operation on loss of control signal, pneumatic air, electric power, network communications, etc.
- C. Phase II – System Commissioning
 - 1. Each HVAC Control System program shall be put on line and commissioned. The contractor shall, in the presence of the Grossmont Union High School District and construction manager, demonstrate each programmed sequence of operation and compare the results in writing. In addition, each control loop shall be tested to verify proper response and stable control, within specified accuracy. System program test results shall be recorded on commissioning data sheets and submitted for record. Any discrepancies between the specification and the actual performance will be immediately rectified and re-tested.
- D. Phase III - Integrated System Program Commissioning
 - 1. Tests shall include, but not be limited to:
 - a. Data communication, both normal and failure modes.
 - b. Fully loaded system response time.
 - c. Impact of component failures on system performance and system operation.
 - d. Time/Date changes.
 - e. Global application programs and point sharing.
 - f. System status displays.

- g. Power failure routines.
 - h. Battery backup.
 - i. Testing of all electrical and HVAC systems with other division of work.
- 2. Submit for approval, a detailed acceptance test procedure designed to demonstrate compliance with contractual requirements. This Acceptance test procedure will take place after the commissioning procedure but before final acceptance, to verify that sensors and control devices maintain specified accuracy and the system performance does not degrade over time.
- 3. Using the commissioning test data sheets, the contractor shall demonstrate each point. The contractor shall also demonstrate 100 percent of the system functions. The contractor shall demonstrate all points and system functions until all devices and functions meet specification.
- 4. The B.M.S. contractor shall supply all instruments for testing. Instruments shall be turned over to the Grossmont Union High School District after acceptance testing.
- 5. All test instruments shall be submitted for approval prior to their use in commissioning.
 - a. Test Instrument Accuracy:
 - 01. Temperature: 1/4F or 1/2% full scale, whichever is less.
 - 02. Pressure: High Pressure (PSI): ½ PSI or 1/2% full scale, whichever is less.
 - 03. Low Pressure: 1/2% of full scale (in w.c.)
 - 04. Humidity: 2% RH
 - 05. Electrical: 1/4% full scale
- 6. After the above tests are complete and the system is demonstrated to be functioning as specified, a thirty-day performance test period shall begin. If the system performs as specified throughout the test period, requiring only routine maintenance, the system shall be accepted. If the system fails during the test, and cannot be fully corrected within eight hours, the Grossmont Union High School District may request that performance tests be repeated.

3.14 CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

A. Demonstration

- 1. Prior to acceptance, the control system shall undergo a series of performance tests to verify operation and compliance with this specification. These tests shall occur after the Contractor has completed the installation, started up the system, and performed his/her own tests.

2. The tests described in this section are to be performed in addition to the tests that the contractor performs as a necessary part of the installation, start-up, and debugging process and as specified in the "Control System Checkout and Testing" article in Part 3 of this specification. The engineer will be present to observe and review these tests. The engineer shall be notified at least 10 days in advance of the start of the testing procedures.
3. The demonstration process shall follow that approved in Part 1, "Submittals." The approved checklists and forms shall be completed for all systems as part of the demonstration.
4. Demonstrate compliance with Part 1, "System Performance."
5. Demonstrate compliance with sequences of operation through all modes of operation.
6. Demonstrate complete operation of operator interface.
7. Additionally, the following items shall be demonstrated:
 - a. DDC control loop response. The contractor shall supply trend data output in a graphical form showing the step response of each DDC control loop. The test shall show the loop's response to a change in set point, which represents a change of actuator position of at least 25% of its full range. The sampling rate of the trend shall be from 10 seconds to 3 minutes, depending on the speed of the loop. The trend data shall show for each sample the set point, actuator position, and controlled variable values. Any loop that yields unreasonably under-damped or over-damped control shall require further tuning by the Contractor.
8. Any tests that fail to demonstrate the operation of the system shall be repeated at a later date. The contractor shall be responsible for any necessary repairs or revisions to the hardware or software to successfully complete all tests.

B. Acceptance

1. All tests described in this specification shall have been performed to the satisfaction of both the engineer and Grossmont Union High School District prior to the acceptance of the control system as meeting the requirements of completion. Any tests that cannot be performed due to circumstances beyond the control of the contractor may be exempt from the completion requirements if stated as such in writing by the engineer. Such tests shall then be performed as part of the warranty.

3.15 CLEANING

- A. The contractor shall clean up all debris resulting from their activities daily. The contractor shall remove all cartons, containers, crates, etc., under his/her control as soon as their contents have been removed. Waste shall be collected and placed in a designated location.
- B. At the completion of work in any area, the contractor shall clean all work, equipment, etc., keeping it free from dust, dirt, and debris, etc.

- C. At the completion of work, all equipment furnished under this section shall be checked for paint damage, and any factory-finished paint that has been damaged shall be repaired to match the adjacent areas. Any cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

3.16 TRAINING

- A. The Contractor shall provide competent instructors to give full instruction to designated personnel in the adjustment, operation and maintenance of the system installed. Factory employed/certified instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach. All training shall be held during normal work hours of 8:00 a.m. to 4:30 p.m. weekdays.
- B. Provide a minimum of two (2) on-site, or classroom training sessions throughout the contract period for personnel designated by the Grossmont Union High School District. Each session shall be a minimum of four (4) hours each.
- C. Since the Grossmont Union High School District may require personnel to have more comprehensive understanding of the hardware and software, additional training must be available from the Contractor. If such training is required by the Grossmont Union High School District, it will be contracted at a later date. Provide description in the Technical Proposal of available local and factory customer training.
- D. Provide course outline and materials in accordance with the "Submittals" article in Part 1 of this specification. The instructor(s) shall provide one copy of training material per student.
- E. The instructor(s) shall be factory-trained instructors experienced in presenting this material.

END OF SECTION

SECTION 23 20 00

HEATING VENTILATING AND AIR CONDITIONING SYSTEMS

PART 1- GENERAL

1.01 SUMMARY

- A. Work under this section provides materials and equipment related to Heating, Air Conditioning and Refrigeration systems.
- B. ~~[Demolish all existing heating, ventilating, and air conditioning systems. None of the existing systems will be reused. Remove from the site all demolished heating, ventilating, and air conditioning systems.]~~
- C. Provide complete Mechanical Submittals and Shop drawings. Refer to Section Heating Ventilating and Air Conditioning System General Provisions 23 01 00 paragraph 1.4 Submittals - Shop Drawings/Product Data/Material Certifications.

1.02 RELATED SECTIONS

- A. Section 23 01 00 - Heating Ventilating and Air Conditioning Systems General Provisions.
- B. Section 23 07 00 - Heating Ventilating and Air Conditioning Insulation.
- C. Section 23 09 00 - Instrumentation and Control for Heating Ventilating and Air Conditioning.

1.03 DEFINITIONS

- A. Ductwork Sizes: Inside clear dimensions. For acoustically lined and internally insulated ductwork, maintain ductwork sizes inside lining or insulation.
- B. Low Pressure: Static pressure in duct 2" water gauge or less, velocity 2000 fpm or less.

1.04 EQUIPMENT AND COMPONENTS REVIEW

- A. Only equipment and components from those manufacturers indicated in this specification are acceptable.
- B. Products from manufacturers which have not previously been thoroughly reviewed and accepted by the GUHSD Representative before the bidding period will not be considered.

1.05 SUBMITTALS

- A. Comply with specification Section 23 01 00 General Provisions for Heating Ventilating and Air Conditioning Systems.

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- B. Require Completed Submittals
 - 1. Duct work fittings and accessories.
 - 2. Sealant.
 - 3. Access panel and doors.
 - 4. Grilles, registers, and diffusers.
 - 5. Filters.
 - 6. HVAC units.
 - 7. Exhaust fans.
 - 8. Fire/smoke dampers and smoke detectors.
 - 9. Vibration Isolation products.
 - 10. Refrigeration piping and piping supports.
- C. Required Shop Drawings
 - 1. Routing of all duct and piping systems.
 - 2. Equipment layout with vibration isolation.

PART 2 - PRODUCTS

2.01 SHEET METAL

- A. Unless otherwise specified, sheet metal used for duct and plenum construction shall be G90 coated galvanized steel of lock forming grade conforming to ASTM standards A653-11. All duct work and supports shall be galvanized. All sheet metal round ducts shall be round spiral lock-seam construction. "Knock down" (KD) duct is not acceptable.
- B. The gauge of the duct and its construction shall be based on low pressure or medium pressure or low or medium velocity. The velocities can be obtained by the duct size and CFM values listed on the drawings. The static pressure for various systems is listed on the mechanical equipment schedule. Refer to the SMACNA standards for the correct duct construction based on the velocities and static pressures involved.
- C. Sealing of Duct Work: All supply and return duct work from mechanical units, all exhaust duct work and all outside air duct work shall have a high pressure Class A seal per SMACNA.
- D. Alumiflex type duct will not be permitted on this project. All ducts are to be rigid galvanized sheet metal.
- E. Exposed round ductwork shall be equal to McGill Round Uni-Light spiral duct, manufactured from G90 galvanized sheet steel meeting ASTM A653-11 (lock forming quality) or equal. The duct and fittings shall be assembled with United Uni-Ramp joints or equal, using sheet metal screws.
- F. All ductwork, fittings, transitions, and hangers exposed to view shall be painted. Provide primer and final coat on all exposed ductwork. The color of the final coat of paint shall be selected by the GUHSD Representative.

- G. All fittings shall be standard design fittings from the same manufacturer as the duct. Branch takeoffs shall be set at 45° to the trunk duct in the direction of the air flow with factory made fittings. All reductions in duct size shall be made in factory fabricated reducing fittings. Elbows with heel taps are not acceptable.
- H. All factory fabricated fittings and joints must be joined using sheet metal screws and duct sealing compound. Ducts made up with sealer shall have a minimum of 2" overlap and sealed with duct sealing compound applied to both parts for the full length of the overlap.
- ~~I. Concealed kitchen hood grease exhaust ducts shall be 16 gauge black steel for both the ducts and fittings. All seams and connections shall be welded. Grease exhaust ducts that are exposed to view shall be 16 gauge stainless steel for both the ducts and fittings. All seams and connections shall be welded.~~
- ~~J. [Concealed and exposed to view fume exhaust ducts shall be 16 gauge 316 stainless steel duct and fittings. All seams and connections shall be welded. All exposed to view fume exhaust ductwork, fittings, transitions, and hangers shall be painted. Provide primer and final coat of paint on all ductwork, fittings, transitions, and hangers. The color of the final coat of paint shall be selected by the GUHSD Representative.]~~
- ~~K. Clothes dryer exhaust ducts to be constructed of galvanized steel duct. Clothes dryer exhaust ducts shall not have fasteners or other projections into the air stream.~~

2.02 FLEXIBLE DUCT

- A. Flexible duct shall only be permitted in concealed tee bar ceilings and at the end of duct run-outs to diffusers or grills. No flex duct shall be exposed to view. The maximum flex length shall be 7 feet.
- B. Flexible ducts shall be installed in as straight a manner as possible. Avoid bends with inside radius of less than one duct diameter. Cut ducts to length required, rather than using bends to take up slack.
- C. Flexible duct shall comply with the UL 181 Class I requirements of the current edition of the California Mechanical Code with a flame spread rating 25 or less and smoke developed rating not higher than 50.
- D. All flexible ducts shall be insulated. Insulation shall be fiberglass with an "R" value of 8.
- E. Flexible Ductwork – Manufactured with a fiberglass scrim reinforced, metallized polyester jacket and polymer water proof liner. Duct shall be factory made and consist of an interior liner that is moisture proof. Interior liner material shall be polymer type. Interior liner shall be air and water tight.
- F. Flexible Ductwork shall be ATCO UPC #031 (R-8) UL 181, Class 1 Air Ducts or equal. Flex duct shall have R-8 double-layer core of each product and is to be wrapped in multiple thicknesses of fiberglass insulation. Jacket shall have rugged and durable fiberglass scrim reinforced, metallized polyester jacket.

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- G. Flexible Duct work - All thermal performance (R-Values) are classified by Underwriters Laboratories in accordance with ADC Flexible Duct Performance and Installation Standard using ASTM C518-10, at installed wall thickness, on flat insulation only. Rated Positive Pressure: 10" w.g. per UL 181 (UL Listed pressure ratings are determined in straight lengths @ ambient temperatures.) Recommended Operating Pressures: (Determined in a 90° bend at elevated temperatures in accordance with ADC FD 72-R1 Test Code.) Maximum Positive: 6" w.g. - 4" thru 12" Dia. 4" w.g. - 14" thru 20" Dia. (With factory installed metal collars, 2" w.g. - all diameters). Maximum Negative: 3/4" w.g. - all diameters. Maximum Velocity: 5,000 FPM.

2.03 ROUND DUCT TAKE-OFF FITTINGS

- A. Take-off fittings for all rigid round ducts shall be at 45 degree angles to the main duct or use a bellmouth fitting. Provide quadrant damper at duct take-off fitting unless otherwise specified.

2.04 DUCT SEALANT

- A. Acceptable manufacturers are Ductmate® Industries – PROseal® and FIBERseal®; and Hardcast, Inc – Sealing System.
- B. Metal to Metal - Duct sealer shall be flexible and self-curing and comply with UL 723 and UL 181B.
- C. Flex Duct - Duct sealer shall be flexible and self-curing and comply with UL 723 and UL 181B-M.
- D. Sealant shall have a flame spread less than 25 and the smoke developed less than 50 when dry.

2.05 ACCESS PANELS AND DOORS

- A. Acceptable manufacturers are Ventfabrics, Inc., C. E. Sparrow Co. and Elmdor / Stoneman MFG.
- B. Access panels in sheet metal work shall consist of three one-piece stampings: the door frame, the door itself and the pan. Space between door and pan shall be filled with 1" thick insulation. The door shall be hung with loose pin hinges.
- C. Access panel sizes shall be as follows unless otherwise specified on drawings:

Size of Duct to be Accessed	Panel Size	Metal Gauges of		
		Frame	Door	Pan
6" - 8"	6" x 8"	24	26	28
10" - 12"	10" x 12"	22	24	28
12" - 16"	12 x 16"	20	24	28
18" and over	16" x 24"	20	22	28

- D. Access doors shall be fabricated in accordance with the details in the SMACNA Duct Construction Standards. Latches and hinges shall be equal to Ventlok of appropriate type and size.

2.06 TURNING VANES

- A. Acceptable manufacturers are Tuttle & Bailey, Invensys Eurotherm (Barber-Colman) and AeroDyne Research.
- B. Turning vanes shall be double-walled and formed to assure that any point on one blade is equidistant from the same point on an adjacent blade.

2.07 BACKDRAFT DAMPERS

- A. Gravity backdraft dampers shall be fabricated multi-blade, parallel action, gravity balanced backdraft dampers of galvanized steel or extruded aluminum, with center pivoted blades linked together; with sealed edges, steel ball bearings, and a plated steel pivot pin.

2.08 FIRE/SMOKE DAMPERS

- A. Acceptable manufacturers are Pottorff, Ruskin Co., Air Balance Inc. or Greenheck.
- B. Provide combination fire/smoke dampers where shown on the drawings.
- C. Wall and concrete floor

1. Fire/smoke closure "motor w/ bimetal links"

- a. Combination fire/smoke dampers will be louver bladed type. Dampers must be tested and listed under both UL 555 and UL 555S. Units must be factory supplied assemblies that consist of damper, sleeve and 1 cycle/year actuator. Dampers must have a minimum class II leakage and dynamic closure rating under UL 555S. Provide units as power-open unless otherwise noted. Actuators to have a minimum operating temperature of 350° F. Seals should be metal to metal without the use of synthetic gasket. Dual temperature thermal switches (DRS-30) rated for 212° F & 350° F, unless otherwise noted. Install in accordance with manufacture's installation instructions provided with units. Provide suitable access for inspection and servicing of each damper. Provide integrated CSFM listed duct smoke detector model 2151 or DH-100 AC/DC "except in the city of LA".
- b. Motor actuators must be by ISO 9000 recognized control manufacturer and certified by ETL laboratories for 1 year continuous power applications such as Invensys, Siemens and Honeywell. Inexpensive stall motors will not be accepted. Dual temperature thermal switches shall be equipped with auxiliary contacts for remote annunciation. Pottorff model FSD 142, CSFM No. 3225-0368: 110 & 3230-0368: 111 or equal.

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D. For corridor ceiling applications

1. Dampers shall be of similar construction to those above except, in tunnel corridor construction where the ceiling construction is similar to that of the wall provide dampers that have been specifically tested and listed for horizontal mounting as corridor dampers under UL 555 and 555S. Pottorff model FSD 172, CSFM No. 3225-0368: 110 & 3230-0368: 111 or equal.
2. Dampers that are installed in corridor ceilings where the construction is (floor/ceiling or roof/ceiling assemblies) that require radiation protection will be radiation dampers that have been tested and listed under both UL 555 and UL 555S. The dampers will have a minimum class II leakage rating. The dampers will be activated by a bimetal, electric link that responds to a signal from a smoke detector, and shall require manual reset. Pottorff model 5680/5660FG, CSFM No. 3225-0368: 006 & 3230-0368: 106 or equal.

E. Each combination fire/smoke damper shall meet all requirements specified for fire dampers and additionally shall include an operating shaft which, when rotated 90 degrees, causes damper to operate between closed and open. Operating shaft and damper combination shall be suitable for linking to an operation by any standard low voltage electric damper operator having sufficient torque characteristics.

F. Provide [Install] a duct smoke detector and provide control wiring and conduit for each combination fire/smoke damper per California Building Code requirements.

2.09 DUCT MOUNTED SMOKE DETECTORS

A. HVAC combined systems with over 2,000 CFM serving a single space.

1. Provide [Install] a duct mounted smoke detector in supply air plenum or in main supply air duct (before any branch ducts) in accordance with current California Mechanical Code Section 609.
2. Provide [Install] a duct mounted smoke detector that will upon detection of smoke shut down the supply fan of HVAC or HV unit when smoke is detected in the supply air duct.
3. [Provide control wiring and conduit from smoke detector to the HVAC or HV unit controls.]
4. [The smoke detector shall be provided by the Fire Alarm Contractor with a set of auxiliary contacts.]

B. Fire/Smoke Damper

1. Provide [Install] a duct mounted smoke detector for each fire/smoke damper that will upon detection of smoke shut the fire/smoke damper and shut down the HVAC or HV associated with this fire/smoke damper when smoke is detected in the supply air duct.
2. [The smoke detector shall be provided by the Fire Alarm Contractor with a set of auxiliary contacts.]

3. [Duct mounted smoke detectors for fire/smoke dampers shall include an additional key controller test and reset switches plus an easily accessible test jack. The key controller test unit shall have self-contained power supply requiring 120 volt or 24volt. Coordinate type and voltage with Division 26.]
- C. [Smoke detector - Shall be listed by Underwriter's Laboratories, Inc. for use in air handling systems. Smoke detectors shall be duct work type and approved for this type of installation. They shall be designed to provide detection of combustion gases and fire and smoke in air conditioning and ventilating duct systems in compliance with the National Fire Protection Association and Underwriter's Laboratories, Inc. Standard U.L. 167. Further, they shall contain an ionization type detector and air sampling chamber with sampling tubes extending through the width of the air duct. Alarm status indicating lights shall be visible on the front of the detector. The smoke detector shall include alarm relay contacts (DPDT) with an extra set of contacts for connection to the fire alarm panel. The duct mounted smoke detector shall be 120 volt or 24volt. Coordinate type and voltage with Division 26 and Fire Alarm Contractor.]

2.10 GRILLES, REGISTERS AND DIFFUSERS

- A. Acceptable manufacturers are Krueger, Titus or Price.
- B. All units must be factory finished. Provide white color finish. Unit ratings shall be approved by ADC.
- C. Air flow tests and sound level measurement shall be made in accordance with applicable ADC equipment test codes and ASHRAE standards. Manufacturer shall certify catalogued performances and ensure correct application of air outlet types.
- D. Positions indicated are approximate only. Check location of supply, return and exhaust grilles and make necessary adjustments in position to conform architectural features, symmetry and lighting arrangement. See architectural reflected ceiling plans and interior elevations for additional information.
- E. Provide splay wires from air distribution to structural building members. Splay wires are used for seismic restraint and shall be attached at each corner with a minimum of 4 splays for each grill.
- F. For dry wall ceilings use "Rapid Mount" frames for access to volume dampers and other items.

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G. Supply Air Distribution - Provide the sizes listed below unless otherwise noted on the drawings.

1. Supply Diffuser - 24" X 24" Perforated lay in Tee-Bar and Modular Core Type. Exposed blades with 4 modular cores that can be removed and repositioned to provide one-way to four-way blow pattern. Square neck type. Hinged perforated face. Krueger Model Number 1240PE with frame style 23. Cores shall be put in four-way blow pattern unless other wise noted. Include square to round transition for duct connection. Standard white color.

CFM	FACE SIZE	NECK SIZE
0 - 100	24" X 24"	6" x 6"
101 - 175	24" X 24"	8" X 8"
176 - 250	24" X 24"	10" X 10"
251 - 400	24" X 24"	12" X 12"
401 - 500	24" X 24"	14" X 14"
501 - 700	24" X 24"	16" X 16"
701 - 850	24" X 24"	18" X 18"

2. Supply Diffuser - 24" X 24" Lay in Tee-Bar and Modular Core Type. Exposed blades with 4 modular cores that can be removed and repositioned to provide one-way to four-way blow pattern. Square neck type. Krueger Model Number 1240 Series with frame style 23. Cores shall be put in four-way blow pattern unless other wise noted. Include square to round transition for duct connection. Standard white color.

CFM	FACE SIZE	NECK SIZE
0 - 100	24" X 24"	6" x 6"
101 - 175	24" X 24"	8" X 8"
176 - 250	24" X 24"	10" X 10"
251 - 400	24" X 24"	12" X 12"
401 - 500	24" X 24"	14" X 14"
501 - 700	24" X 24"	16" X 16"
701 - 850	24" X 24"	18" X 18"

3. Supply Diffuser - Perforated surface mount type, Krueger Model Number F-1100 with frame style 22. Four way deflection unless other wise noted. Concealed hinges. Include square to round transition for duct connection. Standard white color.

CFM	FACE SIZE	NECK SIZE
0 - 100	24" X 24"	6" x 6"
101 - 175	24" X 24"	8" X 8"
176 - 250	24" X 24"	10" X 10"
251 - 400	24" X 24"	12" X 12"
401 - 500	24" X 24"	14" X 14"
501 - 700	24" X 24"	16" X 16"
701 - 850	24" X 24"	18" X 18"

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4. Supply Diffuser - 24" X 24" Surface Mounted and Modular Core Type. Exposed blades with 4 modular cores that can be removed and repositioned to provide one-way to four way blow pattern. Square neck type. Krueger Model Number 1240 Series with frame style 22. Cores shall be put in four-way blow pattern unless other wise noted. Include square to round transition for duct connection. Standard white color.

CFM	FACE SIZE	NECK SIZE
0 - 100	11" X 11"	6" x 6"
101 - 175	13" X 13"	8" X 8"
176 - 250	15" X 15"	10" X 10"
251 - 400	17" X 17"	12" X 12"
401 - 500	19" X 19"	14" X 14"
501 - 700	21" X 21"	16" X 16"
701 - 850	23" X 23"	18" X 18"

5. Supply Grill - Surface Mounted Sidewall Type Diffuser, Krueger Model Number 5880H. Extruded aluminum with double deflection. Include transition from duct size to diffuser size. Two way blow. Standard white color.

CFM	FACE SIZE	NECK SIZE
0 - 75	11 3/4" X 5 3/4"	10" X 4"
76 - 150	11 3/4" X 7 3/4"	10" X 6"
151 - 175	13 3/4" X 7 3/4"	12" X 6"
176 - 225	15 3/4" X 7 3/4"	14" X 6"
226 - 350	19 3/4" X 9 3/4"	18" X 8"
351 - 600	21 3/4" x 11 3/4"	20" X 10"

- H. Return Air Distribution - Provide the sizes listed below unless otherwise noted on the drawings.

1. Return Grill - 24" X 24" Perforated lay in Tee-Bar type, Krueger Model Number 6490 with frame style 23. Concealed hinges. Include square to round transition for duct connection. Standard white color.

CFM	FACE SIZE	NECK SIZE
0 - 100	24" X 24"	6" x 6"
101 - 175	24" X 24"	8" X 8"
176 - 250	24" X 24"	12" X 12"
401 - 500	24" X 24"	14" X 14"
501 - 700	24" X 24"	16" X 16"
701 - 850	24" X 24"	18" X 18"

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2. Return Grill - Surface mounted type, Krueger Model Number 6490 with frame style 22. Concealed hinges. Include square to round transition for duct connection. Standard white color.

CFM	FACE SIZE	NECK SIZE
0 - 100	13" X 13"	6 x 6"
101 - 180	15" X 15"	8" X 8"
181 - 225	16" X 16"	9" X 9"
226 - 280	17" X 17"	10" X 10"
281 - 400	19" X 19"	12" X 12"
401 - 600	22" X 22"	15" X 15"
601 - 800	25" X 25"	18" X 18"

3. Return Grill - Surface Mounted Sidewall Type Return Grill, Krueger Model Number S580H. Extruded aluminum with 3/4" centers. Include transition from duct size to grill size. 35 degree angle blades. Standard white color.

CFM	FACE SIZE	NECK SIZE
0 - 100	11 3/4" X 7 3/4"	10" X 6"
101 - 150	13 3/4" X 7 3/4"	12" X 6"
151 - 200	19 3/4" X 7 3/4"	18" X 6"
201 - 350	19 3/4" X 11 3/4"	18" X 10"
351 - 450	19 3/4" X 13 3/4"	18" X 12"
451 - 600	25 3/4" x 13 3/4"	24" X 12"

- I. Exhaust Grills shall be the same model and size as return grills.

2.11 FLEXIBLE CONNECTIONS

- A. Provide flexible connections at inlet and discharge connections of fans and air handling equipment to prevent mechanical noises from being transmitted to connecting ductwork.
- B. Acceptable manufacturers are Ventfabrics, Inc., and Duro Dyne Corp. UL listed, fire-retardant, neoprene-coated woven glass fiber fabric to NFPA 90A and crimped into metal edging strip.
- C. Ventglas® shall be used for flexible duct connections when not exposed to the weather.
- D. Ventlon® shall be used for flexible duct connections exposed to the weather.

2.12 VOLUME CONTROL DAMPERS

- A. Acceptable manufacturer are Penn Barry, Metal Form Manufacturing Co. and Duro Dyne Corp.
- B. Provide tight close-off dampers at locations indicated on drawings or as needed for control of the air distribution system.
- C. Dampers shall have air loss (leakage), when closed, less than 1% of the full flow rate (based on approach velocity of 2,000 fpm) with a pressure differential across damper 4" static pressure or less.

- D. Construction shall be of No. 22 gauge galvanized blades.
- E. All control rods for volume dampers shall be continuous through-out blade and duct work. Provide locking quadrants and bronze end bushings.
- F. Provide locator flags at each damper adjusting arm consisting of a 12" length of yellow or orange engineering tape.

2.13 FILTERS

- A. Acceptable manufacturers are Camfil Farr or American Air Filter.
- B. Provide two sets of air filters for each HVAC, HV and fan coil unit.
 - 1. The first set of air filters shall be installed during construction and used during the air balance portion of the project.
 - 2. The second set of air filters shall be installed after the air balance portion of the project is finished and prior to the mechanical final punch list site visit.
- C. Air filters for rooftop HVAC and HV units shall be equal to Farr 30/30 2" medium efficiency pleated, disposable type filters.
- D. Air filters for fan coils or furnace units shall be equal to Farr 30/30 [2"] 1" medium efficiency pleated, disposable type filters.
- E. Each filter shall consist of a non-woven cotton fabric media support grid and enclosing frame. Provide Farr Holding Frames factory fabricated of 16 gauge galvanized steel and be equipped with gaskets and four heavy-duty positive sealing fasteners. Each fastener shall be capable of withstanding 25 lbs. of pressure without deflection. They shall be capable of being attached or removed without the use of tools. Filters shall be capable of being installed or removed without any movement of equipment or duct work.
- F. Filters shall have a composite fire hazard rating as tested by ASTM E84, NFPA 255, or UL 723 not to exceed 25 flame spread and 50 smoke developed. Materials labeled accordingly.
- G. Air Filters shall be a California State Fire Marshal approved and listed type. Preformed filters having combustible framing shall be tested as a complete assembly. Air filters in all occupancies shall be Class 2 or better (as shown in the State Fire Marshal Listing). Air filters shall be accessible for cleaning or replacement.
- H. Filters shall conform to ASHRAE 90A-1980 and NFPA 90.

2.14 ROOFTOP PACKAGED HEATING, VENTILATING AND AIR CONDITIONING (HVAC) UNITS, HEAT AND VENTILATION (HV) UNITS AND ACCESSORIES

- A. Acceptable manufacturers of rooftop package HVAC units are Carrier, Trane or York.
- B. Acceptable manufacturers of rooftop HV units are Reznor, Sterling HVAC, or Modine.

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- C. Curbs for HVAC and HV units - Provide a minimum of 16 gauge custom pitched roof curb for each HVAC and HV rooftop unit. The roof curb shall be a single type pitched curb with the slope of the roof curb field measured. The roof curb shall be supported by roof structural support members. Align the roof curb with these support members. The roof curb shall provide a level surface for the installation of the rooftop unit. All curbs shall be rated for seismic zone 4. Provide structural seismic overturning calculations for curbs in submittal. All structural calculations in submittals shall be stamped and signed by a State Certified Structural Professional Engineer.
- D. Vibration Isolation for HVAC and HV units - Provide full perimeter spring vibration isolation rails units which connect to the curbs for rooftop package HVAC and Heat and Vent units as called for on the mechanical schedule. Provide seismic motion restraints as required by California Uniform Mechanical and Building Codes. All vibration isolation shall be rated for seismic zone 4. Provide structural seismic overturning calculations for vibration isolation in submittal. All structural calculations in submittals shall be stamped and signed by a State Certified Structural Professional Engineer.
- E. HVAC Rooftop Units
 - 1. The casing shall be constructed of coated steel meeting SMACNA or ASHRAE Standards. Internal insulation shall meet the requirements of NFPA Bulletin 90-A and UL 181.
 - 2. The unit manufacturer shall furnish, when requested, certified sound power levels for both discharge sound and casing radiated sound, tested in accordance with ASHRAE Standard 36-72.
 - 3. Controls: The units shall be equipped for and shall interface with DDC (Direct Digital Controls) systems.
 - 4. Arrangement and configuration as indicated on drawings and as described on the equipment schedule. Condensing section shall be designed for outdoor duty. Performance shall be certified in accordance with Air Conditioning and Refrigeration institute (ARI) Standard for rooftop HVAC units. Fans to be rated by AMCA.
 - 5. Provide and flex connections on supply and return duct plenums for the isolation of mechanical equipment. These flex connections are for the avoidance of excessive noise or vibration in the building due to the operation of equipment.
- F. HV Rooftop Units
 - 1. The unit shall be designed for 80% thermal efficiency with power vented gas furnace, arranged for duct connection as shown on plans.
 - 2. Unit must include CSA approval as a package. Furnace section only approval is not acceptable.
 - 3. Controls: The units shall be equipped for and shall interface with DDC (Direct Digital Controls) systems.
 - 4. The manufacturer must have a minimum of 8 years experience with gas fired packaged heating equipment.

5. Blower/Cabinet

- a. Blower shall consist of a centrifugal fan, opendrip proof blower motor w/ contactor (motor starter if motor not overload protected) and an adjustable belt drive factory installed. Include all required controls, dampers and inlets to provide an air control cycle of 100% outside air with full cabinet insulation. Cabinet exterior to consist of Galvalum, capable of withstanding 1000 hours of salt spray test in accordance with ASTM A123.
- b. Unit to be equipped for 208/3 supply voltage/phase power supply with a factory installed 24 volt control transformer.
- c. Unit to be equipped with filter rack and 2" 30% efficient pleated disposable filters. See equipment schedule for sizes and quantities.

6. Furnace

- a. All units shall be equipped for use with natural gas, automatic power venter, intermittent spark pilot and two (2) stage gas valve with duct stat. The furnace shall contain a heat exchanger of 409 stainless steel, die formed burner of 409 stainless steel and drip pan of 409 stainless steel.
- b. Furnace to include all required limit and safety controls.

7. Accessories - The following accessories shall be provided:

- a. Downturn plenum (factory installed)
- b. 2 position motorized inlet damper (factory installed)
- c. Filter rack w/ 2" pleated filters (factory installed)
- d. Insulated cabinet (factory installed)
- e. 100% outside air hood (field installed)

2.15 FAN COIL OR FURNACE UNITS

- A. Acceptable manufacturers are Carrier, Trane or York.
- B. Provide factory assembled and tested fan coil or furnace unit design with insulated casing, blower, motor, coils, drain pan and accessories indicated. Drain pan shall extend below valves and fittings at coil connections.
- C. Casing shall be 16 gauge galvanized steel with 1" insulation, supply and return collars, and access panels as indicated.
- D. Blower shall be direct drive with three speeds.
- E. Motor shall be permanent split capacitor, resilient mounts, with oilers and internal thermal protection. Provide adjustable motor sheave on belt drive units to permit a minimum of 10% field adjustment or fan speed.

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- F. Filters shall be 1" [2"] disposable type, maximum 500 FPM in bottom access slide in frame. Contractor shall be responsible for making sure there is adequate space to remove and install filters.
- G. The units shall be equipped and designed for DDC (Direct Digital Controls) systems.
- H. Units shall be suspended and provided with neoprene rubber-in-shear vibration isolators and hanger units. Provide seismic motion restraints as required by California Mechanical and Building Codes. This isolation equipment is for the avoidance of excessive noise or vibration in the building due to the operation of equipment, and due to interconnected piping, ductwork and conduit.
- I. Hanger assembly shall accommodate 3/8" maximum diameter threaded hanger rod for units up to 450 lbs. operating weight and 1/2" diameter threaded hanger for the units 450 to 1000 lbs. The required hanger rods shall be furnished by the installer. Hanger brackets shall be mechanically secured to the fan coil unit. All hanger rods shall have double nuts.
- J. Provide and flex connections on supply and return duct plenums for the isolation of mechanical equipment. These flex connections are for the avoidance of excessive noise or vibration in the building due to the operation of equipment.

2.16 CONDENSING UNITS

- A. Acceptable manufacturer is Carrier, Trane or York.
- B. Arrangement and configuration as indicated on drawings and as described on the equipment schedule. Condensing units shall be weatherized for outdoor duty. Condensing unit performance shall be certified in accordance with Air Conditioning and Refrigeration institute (ARI) Standards.
- C. Provide 1" thick neoprene pads for the isolation of mechanical equipment. This isolation equipment is for the avoidance of excessive noise or vibration in the building due to the operation of equipment.
- D. The units shall be equipped and designed for DDC (Direct Digital Controls) systems.
- E. Provide seismic motion restraints as required by California Mechanical and Building Codes.

2.17 EXHAUST FANS AND ACCESSORIES

- A. Acceptable manufacturers are Greenheck, Loren Cook Co., or Penn Barry. Exhaust fans shall meet AMCA standards.

- B. Provide a custom pitched roof curb for all roof mounted exhaust fans. The roof curb shall be a single type pitched curb with the slope of the roof curb field measured. The roof curb shall be supported by roof structural support members. Align the roof curb with these support members. The roof curb shall provide a level surface for the installation of the roof mounted exhaust fans. Roof mounted exhaust fans and motors shall be designed for outdoor duty.
- C. Provide neoprene rubber-in-shear vibration isolators for all ceiling hung and attic suspended units. Provide seismic motion restraints as required by California Mechanical and Building Codes. This isolation equipment is for the avoidance of excessive noise or vibration in the building due to the operation of equipment, and due to interconnected ductwork and conduit.
- D. The casing shall be constructed of coated steel meeting SMACNA and ASHRAE Standards.
- E. The exhaust fan's manufacturer shall furnish, when requested, certified sound power levels for both discharge sound and casing radiated sound, tested in accordance with ASHRAE Standard 36-72.
- F. Arrangement and configuration as indicated on drawings and as described on the equipment schedule. Performance shall be certified in accordance with Air Conditioning and Refrigeration Institute (ARI) Standard for rooftop HVAC units. Fans to be rated by AMCA.
- G. Provide and flex connections on exhaust inlet and outlet for the isolation of exhaust fans. These flex connections are for the avoidance of excessive noise or vibration in the building due to the operation of equipment.
- H. Exhaust fan motors that are 208/230 volt, 1 or 3 phase and 460 volt, 3 phase shall be provided with motor starters. Provide correct size and voltage characteristics per electrical requirements. Motor starters shall be coordinated with Section 23 09 00 HVAC Instrumentation and Control.
- I. Controls: The units shall be equipped and designed for DDC (Direct Digital Controls), as specified in the mechanical schedule.

2.18 PIPING AND FITTINGS

A. Refrigeration System

- 1. Piping: Type ACR L Hard Copper. Joints: Solder for copper using 95% tin - 5% antimony. Provide wrought copper fittings.
- 2. Fittings: Provide wrought copper fittings.
- 3. Refrigeration Specialties: Provide in line filter dyers at all condensing units in suction piping. Provide shut off valves at each condensing unit. Provide suction line accumulators.

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B. Piping Supports:

1. Supports shall secure pipes in place, shall prevent pipe vibration and maintain required grading of proper adjustment, and shall provide for expansion and contraction.
2. Hangers and roof supports shall be located near or at changes in piping direction and shall provide vertical adjustment to maintain pitch required. All piping mechanically attached to metal studs or bracing shall be attached with approved isolator devices. These isolation devices are for the avoidance of excessive noise or vibration in the building due to the operation of equipment, and/or due to interconnected piping, ductwork or conduit.
3. Hangers and roof supports shall be of strength and rigidity to suit loading and service and in a manner which will not unduly stress the building construction.
4. Hangers and roof supports shall be of adequate size to fit outside the insulation.
5. Provide seismic motion restraints as required by current California Mechanical Code and current California Building Code.
6. Hangers:
 - a. Copper pipe: horizontal - insulated and uninsulated: Adjustable steel clevis of sufficient size to fit outside of insulation.
 - b. Copper pipe: vertical - insulated and uninsulated: Tubing riser clamp carbon steel with copper finish; or figure with plastic coating on formed portion.
7. Hanger Spacing:
 - a. Copper pipe: 1/2" to 2" pipe every 6'- 0" or less.
 - b. Copper pipe: 2" and larger pipe every 8'- 0" or less.
8. Pipe Supports on Roof:
 - a. Roof pipe supports shall be Pipe Pier, flexible resilient closed-cell polyethylene foam (ETHAFOAM brand - trade mark of the Dow Chemical Company), with strut system built into foam block.
 - b. Foam block size:
 - 4" high X 4" wide for 1/2" to 2" pipe diameter pipe
 - 4"high X 6" wide for 2" and larger pipe diameter
9. Pipe Support Spacing on Roof
 - a. Copper pipe: 1/2" to 2" pipe every 6'- 0" or less.
 - b. Copper pipe: 2" and larger pipe every 8'- 0" or less.

~~2.19 — SOUND ATTENUATORS~~

- ~~A. — ACCEPTABLE MANUFACTURER: VIBRO ACOUSTICS AS BASIS OF DESIGN, INDUSTRIAL ACOUSTICS CO. (IAC) OR EQUAL.~~
- ~~B. — DUCT SILENCER ACOUSTICAL AND AERODYNAMIC PERFORMANCE SHALL BE DETERMINED IN ACCORDANCE WITH THE LATEST EDITION OF ASTM STANDARD E477 STANDARD TEST METHOD FOR MEASURING ACOUSTICAL AND AIRFLOW PERFORMANCE OF DUCT LINER MATERIALS AND PREFABRICATED SILENCERS. ALL TESTS SHALL BE CONDUCTED BY A LABORATORY THAT IS ACCREDITED UNDER THE NATIONAL VOLUNTARY LABORATORY ACCREDITATION PROGRAM (NVLAP) TO CONDUCT THE TEST. WHERE TEST DATA IS OBTAINED IN THE MANUFACTURER'S LABORATORY, THE FACILITY SHALL BE AVAILABLE FOR INSPECTION AND WITNESSED TESTING BY THE GUHSD REPRESENTATIVE IN ORDER TO VERIFY COMPLIANCE WITH THE LATEST REVISION OF ASTM STANDARD E477. THE GUHSD REPRESENTATIVE SHALL BE THE FINAL ARBITER IN DETERMINING COMPLIANCE.~~
- ~~C. — THE MANUFACTURER SHALL SUPPLY CERTIFIED TEST DATA FOR EACH SCHEDULED SILENCER. THE DATA SHALL INCLUDE DYNAMIC INSERTION LOSS, GENERATED NOISE AND PRESSURE DROP FOR FORWARD OR REVERSE FLOW, MATCHING THE PROJECT'S AIR DISTRIBUTION SYSTEM REQUIREMENT. ALL RATINGS SHALL BE CONDUCTED IN THE SAME FACILITY AND SHALL UTILIZE THE SAME SILENCER.~~
- ~~D. — TEST FACILITIES AND TEST REPORTS SHALL BE OPEN TO INSPECTION UPON REQUEST FROM THE ENGINEER. SILENCER PERFORMANCE MUST HAVE BEEN SUBSTANTIATED BY LABORATORY TESTING ACCORDING TO ASTM E477-06A AND SO CERTIFIED WHEN SUBMITTED FOR APPROVAL. THE AERO-ACOUSTIC LABORATORY MUST BE NVLAP ACCREDITED FOR THE ASTM E477-06A TEST STANDARD. A COPY OF THE ACCREDITATION CERTIFICATE MUST BE INCLUDED WITH THE SUBMITTALS. DATA FROM NON-NVLAP ACCREDITED TEST FACILITIES WILL NOT BE ACCEPTED.~~
- ~~E. — MATERIALS AND CONSTRUCTION~~
- ~~1. — OUTER CASING CONSTRUCTION: OUTER CASINGS OF RECTANGULAR DUCT SILENCERS SHALL BE MADE OF 22 GAUGE GALVANIZED STEEL IN ACCORDANCE WITH ASHRAE AND SMACNA STANDARDS FOR THE PRESSURE AND VELOCITY CLASSIFICATION SPECIFIED FOR THE AIR DISTRIBUTION SYSTEM IN WHICH IT IS INSTALLED. THE SILENCERS SHALL NOT FAIL STRUCTURALLY WHEN SUBJECTED TO A DIFFERENTIAL AIR PRESSURE OF 8 INCHES WATER GAUGE. CASINGS SHALL BE LOCK-FORMED AND SEALED TO PROVIDE LEAKAGE RESISTANT CONSTRUCTION. AIRTIGHT CONSTRUCTION SHALL BE ACHIEVED BY USE OF A DUCT SEALING COMPOUND SUPPLIED AND INSTALLED BY THE CONTRACTOR AT THE JOB SITE.~~
- ~~2. — INTERIOR CONSTRUCTION: INTERIOR CONSTRUCTION FOR RECTANGULAR DUCT SILENCERS SHALL BE MADE OF NOT LESS THAN 26 GAUGE GALVANIZED PERFORATED STEEL. ALL PERFORATED STEEL SHALL BE ADEQUATELY STIFFENED TO INSURE FLATNESS AND FORM. ALL SPOT WELDS SHALL BE PAINTED.~~
- ~~3. — SOUND ABSORBING FILL MATERIAL: FILL MATERIAL SHALL BE OF INORGANIC GLASS FIBER OF A DENSITY SUFFICIENT TO OBTAIN THE SPECIFIED ACOUSTIC PERFORMANCE. GLASS FIBER SHALL BE PACKED WITH A MINIMUM OF 15% COMPRESSION DURING SILENCER ASSEMBLY. MEDIA SHALL BE BACTERIA AND FUNGUS RESISTANT. IT SHALL BE RESILIENT SUCH THAT IT WILL NOT CRUMBLE OR~~

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~~BREAK. IT SHALL CONFORM TO IRREGULAR SURFACES. MEDIA SHALL NOT CAUSE OR ACCELERATE CORROSION OF ALUMINUM OR STEEL.~~

~~4. COMBUSTION RATING: FILLER SHALL NOT BE LESS THAN THE FOLLOWING WHEN TESTED IN ACCORDANCE WITH ASTM E84, NFPA STANDARD 255 OR UL NO. 723. FLAMESPREAD CLASSIFICATION 15. SMOKE DEVELOPMENT RATING 50~~

~~F. ACOUSTICAL AND AERODYNAMIC PERFORMANCE:~~

~~1. ALL SILENCER RATINGS SHALL BE DETERMINED IN A DUCT TO REVERBERANT ROOM TEST FACILITY WHICH PROVIDES FOR AIRFLOW IN BOTH DIRECTIONS THROUGH THE TEST SILENCER IN ACCORDANCE WITH THE ASTM E477-06A TEST STANDARD. THE TEST SET-UP, PROCEDURE AND FACILITY SHALL ELIMINATE ALL EFFECTS DUE TO FLANKING, DIRECTIVITY, END REFLECTION, STANDING WAVES AND REVERBERATION ROOM ABSORPTION.~~

~~2. SILENCER PRESSURE DROPS SHALL NOT EXCEED THOSE LISTED IN THE SILENCER SCHEDULE. SILENCER PRESSURE DROP MEASUREMENTS SHALL BE MADE IN ACCORDANCE WITH THE ASTM E477-06A TEST STANDARD. TESTS SHALL BE CONDUCTED AND REPORTED ON THE IDENTICAL UNITS FOR WHICH ACOUSTICAL DATA IS PRESENTED.~~

PART 3 – EXECUTION

3.01 DUCT CONSTRUCTION AND INSTALLATION

- A. Ductwork construction and installation including sheet metal gauges, reinforcement, joint sealing, air leakage and details not specifically shown on the drawings shall be in accordance with SMACNA Publication HVAC Duct Construction Standards - Metal and Flexible current edition and SMACNA Publication Seismic Restraint Manual: Guidelines for Mechanical Systems current edition.
- B. Use Ductmate Duct Connection System for all transverse joints in ducts.
- C. Seal seams, joints, duct connections, elbow gores with Hardcast high pressure Class A SMACNA sealant.
- D. Radius elbows shall have a center line radius equal to 1-1/2 times the duct width. Square throats will not be permitted on radius elbows. Square elbows shall have double thick turning vanes. Job fabricated turning vanes will not be accepted without prior approval.
- E. Provide all necessary dampers as required for proper adjustment and control of air distribution. All dampers shall have rigid bearings and locking quadrants which allow no rattling. All damper rods shall be marked to indicate the relative position of the damper blade with respect to the rod. Install fire dampers in accordance with their UL listing and the manufacturer's recommendations.
- F. All grilles, registers, and diffusers shall be set flush and true to the wall or ceilings to prevent air leakage around the edges. Provide plaster frames for all outlets in plaster or gypsum board.

- G. Provide 1" angle collars for all exposed ducts passing through roofs, ceilings, floors and walls. Anchor collars in position after installation is complete.
- H. At all places where inside of duct will be visible through return air grilles, louvers, etc., paint normally visible inside portion of duct with flat black paint.
- I. Install hinged doors on ductwork and housing to provide access to all parts of every automatic damper, fire damper and all other items requiring maintenance or inspection.
- J. Transitions in ductwork, in changing shapes and sizes, shall be made with angles not exceeding 15° wherever possible. Maximum divergence upstream of equipment shall be 30° and maximum convergence downstream shall be 45°.
- K. Where horizontal ducts pass through walls and vertical ducts pass through roof or floors, supporting angles shall be rigidly attached to ducts and to the wall, roof or floor. Angles shall be galvanized and of approved sizes to properly support the ductwork. The supporting angles shall be placed on at least two sides of the duct.
- L. Where horizontal ducts pass through walls and vertical ducts pass through roof or floors, the openings shall be tightly sealed off so as to provide a air and sound tight seal between duct and opening.
- M. Contractor shall not provide holes in the duct systems for the installation of hangers, conduits, etc. Coordinate work of all other trades so this will not be necessary.
- N. Ensure that interior of ducting is kept clean during building construction. Install plastic film over exposed duct openings while in storage and as soon as ducts are installed.
- O. Locate duct with sufficient space around equipment to allow normal operating and maintenance activities.
- P. All supply air, return air, outside air and exhaust air ductwork joints and seams to be sealed through their entirety with high pressure Class A SMACNA duct sealant.
- Q. Complete metal ducts within themselves with no single partition between ducts. Where width of duct exceeds 18 inches, cross break for rigidity. Open corners are not acceptable.
- R. Lap metal ducts in direction of air flow. Hammer down edges and slips to leave smooth duct interior.
- S. Construct tees, bends and elbows with radius of not less than 1-1/2 times width of duct on center line. Where not possible and where rectangular elbows are used, provide approved type airfoil turning vanes.
- T. Clothes dryer exhaust ducts shall be fabricated with no screws or other penetrations into the air stream.
- U. Weather exposed ductwork is not acceptable.

3.02 FLEXIBLE DUCTWORK

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- A. Connect flexible ducts to metal ducts with metal draw bands plus sheet metal screws.
Use crimp joints with bead for joining round duct sizes with crimp in direction of airflow.

3.03 FLEXIBLE CONNECTIONS

- A. Provide flexible connections at inlet and discharge connections of fans and air handling equipment to prevent mechanical noises from being transmitted to connecting ductwork. Align sheet metal duct with fan or fan casing opening in all three dimensions prior to installation of flexible connection, so that duct opening nearly coincides and are almost equally spaced from one another all around. Do not install flexible connection until above requirements are met. Fans or fan casings and ducts shall be able to move 1" in any direction relative to each other without short-circuiting metal to metal or stretching taut the flexible connection.

3.04 ROOFTOP HVAC UNITS, HEAT AND VENT UNITS, FAN COIL AND CONDENSING UNITS AND EXHAUST FANS

- A. Install equipment in accordance with manufacturer's recommendations, good industry standards and SMACNA Installation Standards for Heating, Air Conditioning and Solar systems.
- B. Provide high pressure air seal around ducts and units.
- C. Roof mounted exposed ductwork is not acceptable.
- D. Coordinate with other work, including ductwork, floor construction, and electrical work as necessary to interface installation of air handling equipment with other work.
- E. Ensure equipment is wired properly, with rotation in direction indicated and intended for proper performance. If there is no rotation arrow supplied by the manufacturer, install a correct rotation arrow.
- F. Inlet and outlet connections to all equipment shall be made with neoprene coated glass fabric flexible connection not less than four inches full length with one inch slack. Weather exposed connections shall be same as above except to be hypalon coated in lieu of neoprene.
- G. Connect motor starters at equipment to DDC control system, on/off light switches or "on temperature rise thermostats"

3.05 ACCESS DOORS

- A. Provide access doors as specified for inspection and cleaning before and after coils, at fire dampers, at fire/smoke dampers, at volume dampers, and elsewhere as indicated or as required. Review locations prior to fabrication.
- B. Locate access doors for easy access. Doors should be located above accessible ceilings, whenever possible. Where access is required above gypsum board ceilings, coordinate location of access panel with Contractor. Coordinate location of access doors with other trades such that conduit and pipe does not prevent or interfere with access to ductwork.

3.06 FIRE/SMOKE DAMPERS

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- A. Install fire/smoke dampers in accordance with current California Mechanical Code and current California Building Code requirements, manufacturer's recommendations and State Fire Marshal recommendations.
- B. Provide [Install] a smoke detector up stream of the fire/smoke dampers that will upon detection of smoke close the fire/smoke damper.
- C. Provide wiring and conduit from smoke detector [by others] to the fire/smoke damper so that the fire/smoke damper will close.

3.07 SMOKE DETECTORS

- A. HVAC units over 2,000 CFM - Provide [Install] smoke detectors in supply air plenum or in main supply air duct (before any branch ducts) in accordance with current California Mechanical Code.
 - 1. Provide [Install] a duct mounted smoke detector [furnished by Fire Alarm Contractor] that will upon detection of smoke shut down the supply fan of HVAC unit when smoke is detected in the supply air duct.
 - 2. Provide control wiring and conduit from smoke detector [furnished by Fire Alarm Contractor] directly to the HVAC unit controls.
 - 3. [Provide wiring and conduit so that alarm signal can be connected to the DDC control panel and to the fire alarm panel.]
- B. Fire/Smoke Dampers - Furnish and install a smoke detector up stream of each fire/smoke damper.
 - 1. Provide [Install] a duct mounted smoke detector [furnished by Fire Alarm Contractor] that will upon detection of smoke shall close fire/smoke damper.
 - 2. Provide control wiring and conduit from smoke detector [furnished by Fire Alarm Contractor] directly to the fire/smoke damper.
 - 3. [Provide wiring and conduit so that alarm signal can be connected to the DDC control panel and to the fire alarm panel.]

3.08 REFRIGERATION PIPING INSTALLATION

- A. All piping shall be concealed in walls, furred spaces, pipe spaces, or above suspended ceilings. Piping shall be grouped wherever practical and shall be installed uniformly in straight parallel lines in either vertical or horizontal positions and at right angles with beams, walls, ceilings or other building lines. Install all exposed piping as close as practical to walls, columns or overhead construction to provide maximum head room and minimum interference with usable building space. Where interference develops in the field, piping shall be offset or routed as required.
- B. Pipe shall be installed to eliminate sagging.
- C. All pipe, fittings and valves shall bear manufacturer's name and trademark, and valves shall have service and pressure rating cast in bodies.

- D. Copper piping passing through poured concrete floors shall be sleeved and wrapped with plastic foam or fire stop material as appropriate with 50% overlap.

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3.09 PIPE SUPPORT SPACING AND LOCATIONS

- A. Hangers shall adequately support the piping system and shall be located near or at changes in piping direction and concentrated loads.

3.10 PIPE TESTING

- A. All piping system shall be tested and proven tight prior to concealment.
- B. Insure that the test pressure which might damage equipment does not reach such units by valving them off or otherwise isolating them during the test.
- C. All air tests shall be held for a minimum of four hours without loss of pressure.

~~3.11 SOUND ATTENUATOR INSTALLATION~~

- ~~A. Install where shown on Drawings in accordance with the manufacturer's recommendations to obtain the published acoustical and air flow performance.~~
- ~~B. Sound trap baffles should be oriented so as to be parallel to the plane of the turn if the sound trap is located in a position less than 3 duct diameters in distance from the elbow. The duct diameter shall be based upon the maximum duct cross sectional dimension of the sound trap.~~
- ~~C. If the sound trap is located greater than 3 duct diameters away from an elbow, the orientation is not critical.~~
- ~~D. With the exception of elbow silencers, locate no rectangular sound attenuators within one duct diameter from elbows, fan suction or discharge openings, takeoffs, etc. unless indicated on the drawings.~~

3.123.11 DUCTWORK TESTING

- A. Leak test supply air ductwork during construction and prior to installation of duct wrap. Leakage shall not exceed of 1% of the total design CFM when tested at 1-1/2 times the design air pressure or the minimum requirement as set forth by SMACNA HVAC Duct Construction Standards. Notify GUHSD Representative 24 hours in advance of test. Keep field records of tests and submit to Architect Mechanical Engineer Owner's Representative three copies of results.
- B. Retesting: Retest ductwork failing initial tests following correction of defective work. Requirements of initial tests shall apply.

END OF SECTION

SECTION 26 00 00

GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Provide a complete and operable installation, including all labor, supervision, materials, equipment, tools, apparatus, transportation, warehousing, rigging, scaffolding and other equipment and services necessary to accomplish the work in accordance with the intent and meaning of these drawings and specifications.

1.03 DEFINITIONS

- A. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.
- B. CalGreen: California Green Building Standards, CCR Title 24 Part 11, Chapter 5.
- C. "Codes" or "Code" means all codes, laws, statutes, rules, regulations, ordinances, orders, decrees, and other requirements of all legally constituted authorities and public utility franchise holders having jurisdiction.
- D. "Extend", "Submit", "Repair" and similar words mean that the Contractor shall accomplish the action described.
- E. "Products", "materials" and "equipment" are used interchangeably and mean materials, fixtures, equipment, accessories, etc.
- F. "Provide" means furnish, install and connect unless otherwise described in specific instances.

1.04 RELATED WORK

- A. Coordination: Refer to Architectural and Mechanical Drawings for the construction details and coordinate the work of this Division with that of other Divisions. Order and execute the work of this Division so that progress will coordinate with that of other Divisions and all work will proceed expeditiously. The work of this Division shall include direct responsibility for the correct placing and connection of electrical work in relation to the work of other Divisions. Examine other Divisions for work related to the work of this Division especially Division 23 – HVAC (Mechanical).

1.05 EXISTING CONDITIONS

- A. Visit the site prior to bidding and investigate the existing conditions which affect or will be affected by the work of this Division. Become thoroughly familiar with the working conditions and take into account any special or unusual features peculiar to this job. By the act of submitting a Bid, the Contractor will be deemed to have complied with the foregoing, to have accepted such conditions, and to have made allowance therefore in preparing his Bid.

1.06 DRAWINGS AND SPECIFICATIONS

- A. Drawings and specifications are intended to complement each other. Where a conflict exists between the requirements of the drawings and the specifications, request clarification.
- B. The District's representative shall interpret the drawings and the specifications, and his decision as to the true intent and meaning thereof and the quality, quantity, and sufficiency of the materials and workmanship furnished thereunder shall be accepted as final and conclusive.
- C. In case of conflicts not clarified prior to Bidding deadline, use the most costly alternative (better quality, greater quantity or larger size) in preparing the Bid. A clarification will be issued to the successful Bidder as soon as feasible after the Award and if appropriate a deductive change order will be issued.

1.07 PERMITS AND INSPECTIONS

- A. Obtain, schedule and pay for permits, licenses, approvals, tests, and inspections required by legally constituted authorities and public utility franchise holders having jurisdiction over the work.
- B. Afford the District's representative every facility for evaluating the skill and competence of the mechanics and to examine the materials. Concealed work shall be reopened when so directed during his periodic visits.

1.08 ELECTRIC POWER SERVICES

- A. Within 5 days after award of contract, notify the serving utilities that the project is under construction and apply for permanent service in the name of the District. Furnish pertinent information to them including the required dates for permanent service. Verify service locations and conform to utility company requirements. Contractor shall pay charges for permanent service connections levied by the utilities for which he will be reimbursed by the District. The reimbursement shall be limited to the actual amount of the utility service charges and a copy of the billing from the utility company shall accompany the Contractor's invoice. Arrange and pay for the Construction power and lighting including the utility service.

1.09 CODES AND REGULATIONS

- A. By submitting a Bid, Contractor is deemed to represent himself as competent to accomplish the work of this Division in conformance with applicable Codes. The Contract Documents may require installations which exceed Code requirements, but are not intended to allow installations which are below minimum Code requirements. In case of conflict where the Contract Documents are below the minimum requirements of applicable Codes, the Codes shall take precedence. Should such conflicts appear, cease work on the parts of the contract affected and immediately notify the Architect in writing. It shall be the Contractor's responsibility to correct, at no cost to the District, any work he executes in violation of Code requirements.

- 1. Applicable Codes: (Current adopted editions except as noted):

- a. California Electrical Code
- b. California Building Code
- c. California Fire Code

- d. Fire Marshal Regulations
- e. Regulations of all other authorities having jurisdiction.

2. Where conflict or variation exists amongst Codes, the most stringent shall govern.

1.10 TESTS

- A. Demonstrate that all components of the work of this Division have been provided and that they operate in accordance with the Contract Documents.
- B. Provide instruments and personnel for tests and demonstrations. Submit signed test results.
- C. Notify the District's representative seven (7) days in advance of tests to allow presence of District's representative.
- D. Test wiring and connections for continuity, short circuits and improper grounds. Test each lighting panel with mains disconnected from feeders, branches connected, wall switches closed, and fixtures permanently connected and complete with lamps. Test each individual power circuit at panel with the power equipment connected for proper operation.

1.11 RECORDS AND DOCUMENTATION

- A. Accumulate the following and deliver to the District's representative prior to final acceptance of the work.
- B. Record (As-Built) Drawings: Maintain in good order in the field office a complete set of electrical prints. Update the drawings daily with neat and legible annotation in red ink showing the work as actually installed.
- C. Permits and Certificates of Inspection: Furnish the originals.

1.12 SUBMITTALS

- A. Within 15 days after award of Contract, submit for approval a complete list of materials proposed for use. Furnish names and addresses of manufacturers, catalog numbers (where applicable) types and trade names. For purposes of uniformity, only one manufacturer will be accepted for each class or type of material. This list is in addition to Shop Drawings.
- B. Submit shop drawings with such promptness as to cause no delay in the work. Do not commence fabrication of the equipment until the approved drawings are received from the District's representative. Shop Drawings and/or brochures are required for the panelboards, safety switches, motor control, and lighting fixtures.
- C. Product Data
 - 1. Material List: A material list with names of manufacturers, model numbers, and technical information on all equipment proposed.
 - 2. Product technical information sheets for each principal component in the proposed system. Identify by arrow, circle or similar means products being proposed. Submittals consisting of unmodified catalog pages with no markings will be rejected.

3. Weight, dimensions and shipping splits.
4. Equipment operating and service (maintenance) clearances required around the equipment.
- D. Test Procedures: A written document detailing the proposed test procedures of the system shall be supplied. These procedures shall include all tests required by the equipment manufacturer and by this specification.
- E. Test Results Report: The results of the execution of the testing procedure, including the items tested or inspected, the date, and by whom.
- F. Operating Sequences: Provide a complete written description of the Sequence of Operation of each of the systems including startup and recovery procedures
- G. Samples: when requested by Architect
- H. Operation and Maintenance (O&M) Manuals: Furnish composite "Systems Operation and Maintenance" manuals in indexed three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain, but not be limited to:
 1. Operational procedures for the overall systems including the "Sequence of Operation".
 2. Test procedures and test results.
 3. Instruction for the proper operation and maintenance of the system.
 4. Factory issued technical, installation, and maintenance manuals.
 5. Factory issued operations and programming (software) manuals.
 6. A replacement parts list complete with part numbers and name, address, and phone number of suppliers used by the Contractor. A spare parts list recommended for purchase by the District shall be included.
 7. All portions of the material list and shop drawings which are not included in the foregoing.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Materials shall be new, in accordance with the specification of the Institute of Electrical and Electronic Engineers, National Electrical Manufacturer's Association, National Fire Protection Association, and the California Electrical Code, and shall have an Underwriter's Laboratories listing and bear their label where such service is available.
- B. Materials for the same purpose shall be of the same make and shall be the manufacturer's latest standard design that complies with the specification requirements.
- C. Whenever on the plans, or in these specifications, products are identified by the name of one manufacturer, it is intended that equivalent products of other manufacturers are acceptable, unless otherwise indicated, if accepted in writing by the District's representative. However, where three or more manufacturers are mentioned, then the products furnished shall be the product of one of the manufacturers listed. In general, the

following manufacturers are considered qualified bidders on the listed categories. Manufacturers listed shall meet quality and performance of a particular item specified by both name and number.

- D. Source Limitations: Obtain materials and accessories from single source from single manufacturer.
- E. Substitutions: Should the Contractor desire to substitute for specified products, he shall submit with the Material List a complete list of the requested substitutions. The request shall contain complete descriptive information of the products. Samples for evaluation shall also be submitted upon the District's representative request. If, in the District's representative opinion, the materials as presented in this first submittal is in variance with the specified material, or if the information submitted is not sufficiently complete to allow proper evaluation, the substitution will be disallowed from consideration and the specified materials shall be furnished.

2.02 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.
- B. Comply with CEC.

PART 3 - EXECUTION

3.01 WORKMANSHIP AND INSTALLATION METHODS

- A. Workmanship shall be in conformance with NECA 1 and the best standard practice of the trade except where indicated otherwise.
- B. Execute the work so as to contribute to ease of operation and maintenance, maximum accessibility and best appearance. Execute it so that the installation will conform and adjust itself to the building structure, its equipment and its usage. The work shall be symmetrical, plumb, uniform, properly aligned and firmly secured in place.
- C. Install equipment in accordance with the manufacturer's instructions and recommendations unless otherwise noted or specified.

3.02 LOCATIONS, SIZES, ROUTINGS AND CLEARANCES

- A. For the purpose of clearness and legibility, the drawings are essentially diagrammatic. The size and location of equipment is shown to scale wherever possible, but the Contractor shall make use of all the data in the Contract Documents, and shall verify such information. Contractor is responsible for the equipment provided by him fitting in the spaces available while maintaining required working, ventilation, and equipment maintenance access space. Exercise particular care that such space is not infringed by the work of other Divisions.
- B. Conduit and Cable Routing: The drawings show the points of termination, and may suggest a route, for the conduit and cables. However, it shall be the responsibility of the Contractor to install the conduits and cables with a minimum number of bends in such a manner as to conform to the structure, avoid obstructions, preserve headroom, keep openings and passageways clear, and meet all Code requirements with such offsets and special fittings as may be required.

- C. Any outlet, wall switch or wiring device may be relocated within a radius of six feet at no additional charge to the District if such request is made prior to installation of the item and its branch circuit.

3.03 CUTTING AND PATCHING

- A. Perform drilling, cutting, and patching of the general construction work, which may be required for the installation. Patch with the same materials, workmanship and finish as the original work and accurately match all surrounding work. Such work shall be done by a craftsman accredited in the applicable trade and be acceptable to the Architect.

3.04 GROUNDING AND BONDING

- A. Ground and bond the electrical system and equipment in accordance with the most stringent of applicable codes but with the requirements herein and on drawings to be the minimum standards.
- B. System Grounding Electrode:
 - 1. Provide a grounding electrode as indicated on the drawings, and bond to the service ground point in the main switchboard.
 - 2. Where available on the premises and in accordance with Code requirements, the water piping system shall be bonded to form a grounding electrode system as described in CEC Article 250.
- C. Bonding:
 - 1. Provide piping system bonding in accordance with Article 250.
- D. Grounding System Testing:
 - 1. All testing shall be performed using laboratory accuracy test instruments of suitable design for the tests to be performed. Such instruments shall show a valid calibration label.
 - 2. Test the continuity of and the proper connection of each ground conductor and system to assure that the grounding system is complete and proper. The following shall be tested:
 - a. New grounding electrodes.
 - b. Grounding conductors of all existing wiring which is reused.
 - c. Grounding conductors of new wiring for feeders and branch circuits larger than 20 amperes.
- E. All portions of the installations which fail to pass these tests shall be replaced, repaired or otherwise corrected to the satisfaction of the Architect at no cost to the District. It is recommended that Contractor perform grounding system quality assurance testing as the work progresses and prior to the work becoming inaccessible by drywall installation.
- F. The results of these tests shall be submitted by the Contractor as part of the project close-out submittal and shall show the date of test, instrument used, Contractor's name and name of person performing the tests, name of persons witnessing the test, test data, actual

measured minimum value per Code/IEEE and a statement whether the measured values are within acceptable limits.

3.05 DELIVERY, HANDLING, STORAGE OF MATERIALS AND PROTECTION OF WORK

- A. Protect materials against dirt, water, chemical and mechanical damage both while in storage and during construction.
- B. Cover materials in such a manner that no finished surfaces will be damaged, marred or splattered with plaster or paint, and all moving parts will be kept clean and dry.
- C. Replace or refinish any damaged materials including fronts of panels and switchboard sections.
- D. Keep raceways, boxes, cabinets, and other openings closed to prevent entry of foreign matter.

3.06 CLEANUP AND HOUSEKEEPING

- A. Cleaning shall be done as the work proceeds. Periodically remove waste and debris to keep the site as clean as is practical.
- B. Leave exposed parts of the electrical work in a neat, clean and usable condition, with painted surfaces unblemished and plated metal surface polished. Clean lighting fixtures and wipe lamps clean.

END OF SECTION

SECTION 26 05 19

LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Building wires and cables rated 600V and less.
- B. Connectors, splices and terminations rated 600V and less.

1.03 DEFINITIONS

- A. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.

1.04 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member of NETA or an NRTL.

1.05 SUBMITTALS

- A. Product Data
 - 1. Material List: A material list with names of manufacturers, model numbers, and technical information on all equipment proposed.
 - 2. Product technical information sheets for each principal component in the proposed system. Identify by arrow, circle or similar means products being proposed. Submittals consisting of unmodified catalog pages with no markings will be rejected.
- B. Test Procedures: A written document detailing the proposed test procedures of the system shall be supplied. These procedures shall include all tests required by the equipment manufacturer and by this specification.
- C. Test Results Report: Test Results Report: The results of the execution of the testing procedure, including the items tested or inspected, the date, and by whom.
- D. Samples: when requested by Architect
- E. Operation and Maintenance (O&M) Manuals: Furnish composite "Systems Operation and Maintenance" manuals in indexed three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain, but not be limited to:
 - 1. Operational procedures for the overall systems including the "Sequence of Operation".
 - 2. Test procedures and test results.
 - 3. Instruction for the proper operation and maintenance of the system.

4. Factory issued technical, installation, and maintenance manuals.
5. Factory issued operations and programming (software) manuals.
6. A replacement parts list complete with part numbers and name, address, and phone number of suppliers used by the Contractor. A spare parts list recommended for purchase by the District shall be included.
7. All portions of the material list and shop drawings which are not included in the foregoing.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- 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. Building Wire
 - a. Anaconda
 - b. BICC
 - c. General Cable
 - d. Okonite
 - e. Parante Circle
 - f. Phelps-Dodge
 - g. Pirelli
 - h. Rome
 - i. Simplex
 - j. Triangle
 - k. Or equal
2. Multi-conductor Cable:
 - a. Alpha Wire
 - b. Belden
 - c. Encore
 - d. General Cable
 - e. Southwire
 - f. Or Equal
3. Metal Clad Cable
 - a. AFC
 - b. General Cable
 - c. Or equal
4. Wire Pulling Compound:
 - a. Minerallac
 - b. Wyrease
 - c. Ideal

d. Or equal

2.02 GENERAL

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.
- B. Comply with CEC.
- C. Deliver wire and cable to the site in their original unbroken packages, plainly marked or tagged with UL label, size and insulation type, and manufacturers name.

2.03 CONDUCTORS

- A. Soft drawn copper, solid for No. 12 AWG and smaller, stranded for No. 10 AWG and larger or for connections to vibrating equipment or control wiring. Minimum size No. 12 unless noted otherwise. Aluminum conductors shall not be permitted.

2.04 INSULATION

- A. Moisture resistant thermoset type XHHW-2 90°C for all underground feeders. Thermoplastic type THHN/THWN-2 90°C for feeders in dry locations and for all branch circuits, except provide high temperature insulations in abnormally high ambient temperatures as applicable.
- B. Equipment and electrode ground wires may be uninsulated in conformance with codes, and where indicated.
- C. Certain circuit breakers such as 100% rated circuit breakers may require the use of 90 degree C insulated wire (sized at the 75 degree C ampacity). If it is required it will be marked as such by the manufacturer.

2.05 CONNECTIONS AND TERMINATIONS

- A. Use Pressure indenter type or self-threading spring wire connectors for sizes up to the catalog capacity of the connector. 3M Scotchlok, Ideal Supernut or Buchanan B Cap. Push-In wire connectors may be used for the solid and stranded wire (including stranding patterns) for which they are UL listed. Ideal In-Sure.
- B. Use clamp type pressure connectors complete with clip held insulating cover for large sizes or capacities. As manufactured by Burndy, O.Z. or T & B.
- C. In above grade dry locations wrap joints with two layers of plastic tape, half lapped, Scotch No. 33. For splices involving conductors 4 AWG and larger, provide pre-insulated lug kits listed for the conductor size(s) and materials being joined. As manufactured by IlSCO, Penn Union, or equal.
- D. Wiring in underground pullboxes shall be spliced using compression connectors and resin encapsulation kits, 3M Scotch-cast, or equal; or shrink tubing kits. Splices shall be completely waterproof.
- E. Bolted connections to equipment or busbars shall be made with approved solderless compression type or set screw type lugs for wires No. 8 AWG and larger. Special connections shall be as shown on the plans. Binding screws may be used for size No. 12 solid.

2.06 METAL CLAD CABLE

- A. Comply with NEMA WC 70/ICEA S-95-658 for metal-clad cable, Type MC. Provide an insulated equipment ground wire throughout.

2.07 PULLING COMPOUND

- A. Minerallac #100, Wyrease, Ideal 77 Yellow or equal.

2.08 COLOR CODING

- A. Comply with identification requirements of Division 26 Section "Identification for Electrical Systems."

PART 3 - EXECUTION

3.01 APPLICATION

- A. All conductors shall be installed in conduit or other approved raceway.
 - 1. Exception: Where permitted by CEC, Metal Clad (MC) cable may be used for lighting circuits and for 2-wire 120V wall convenience receptacle branch circuits in lieu of conduit and wire for concealed accessible applications (above accessible ceilings) and for drops into stud walls to receptacle and switches. MC Cable may not be used for home runs, multi-wire circuits or be run exposed. All home runs shall be in EMT. MC Cable may be used to power more than one device on the circuit and in this situation, be run horizontally as shown on the plans. Provide protection at studs, per CEC.

3.02 DEMOLITION

- A. All existing wiring not being reused shall be removed back to the switchboard, panel or first active outlet box. Vacated conduit shall be removed unless removal would damage the structure. Place blank faceplates on all vacated boxes left in place.

3.03 INSTALLATION

- A. Install wiring in conduit unless noted or specified otherwise. Raceways shall be clean and dry before cable installation.
- B. Complete raceway and cable tray installation before installation of conductors.
- C. Do not exceed manufacturer's recommended pulling tension or minimum bending radius.
- D. Tighten connections in accordance with manufacturer's published torque.
- E. Provide a dedicated neutral for all 20 amp, 277V or 120V branch circuits. Multi-wire circuits shall not be provided for 277V or 120V loads. Exception: Multi-wire circuits shall be provided for systems furniture feeds in accordance with CEC 210.4 when indicated by the furniture manufacturer's installation instructions.
- F. Do not use mechanical devices for pulling No. 2 AWG and smaller wire. Torque limiting types may be used for No. 1 and larger sizes but tensions shall not exceed cable manufacturer's recommendations.

- G. Form wire into pigtail splices with 8 inch leads for connections to wiring devices and fixtures.
- H. Comply with identification requirements of Division 26 Section "Identification for Electrical Systems."
- I. Attach identification tags to wire and cable at every point where runs are broken or terminated. Exception: Branch circuits need only be tagged at their point of origin. Neutrals for all 120 volt, 2 wire branch circuits shall be tagged in the panelboard with the circuit number or shall be grouped as required by CEC 210.4(D).
- J. Provide a pullbox or wireway transition from conduit to MC Cable.
- K. Splices shall not be permitted in feeders unless noted otherwise.

3.04 FIELD QUALITY CONTROL

- A. All new or existing wire damaged as a result of installation or removal of wire under this Section, shall be pulled out and replaced with new at no additional charge. All existing wire found to be damaged or inadequate shall be called to the attention of the District's representative.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes grounding and bonding systems and equipment

1.03 DEFINITIONS

- A. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.
- B. NRTL: Nationally Recognized Testing Laboratory

1.04 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.
- C. Comply with UL 467 for grounding and bonding materials and equipment.

1.05 SUBMITTALS

- A. Product Data
 - 1. Material List: A material list with names of manufacturers, model numbers, and technical information on all equipment proposed.
 - 2. Product technical information sheets for each principal component in the proposed system. Identify by arrow, circle or similar means products being proposed. Submittals consisting of unmodified catalog pages with no markings will be rejected.
 - 3. Weight, dimensions and shipping splits.
 - 4. Equipment operating and service (maintenance) clearances required around the equipment.
- B. Shop Drawings
- C. Test Procedures: A written document detailing the proposed test procedures of the system shall be supplied. These procedures shall include all tests required by the equipment manufacturer and by this specification.

- D. Test Results Report: The results of the execution of the testing procedure, including the items tested or inspected, the date, and by whom.
- E. Operating Sequences: Provide a complete written description of the Sequence of Operation of each of the systems including startup and recovery procedures
- F. Samples: when requested by Architect
- G. Operation and Maintenance (O&M) Manuals: Furnish composite "Systems Operation and Maintenance" manuals in indexed three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain, but not be limited to:
 - 1. Operational procedures for the overall systems including the "Sequence of Operation".
 - 2. Test procedures and test results.
 - 3. Instruction for the proper operation and maintenance of the system.
 - 4. Factory issued technical, installation, and maintenance manuals.
 - 5. Factory issued operations and programming (software) manuals.
 - 6. A replacement parts list complete with part numbers and name, address, and phone number of suppliers used by the Contractor. A spare parts list recommended for purchase by the District shall be included.
 - 7. All portions of the material list and shop drawings which are not included in the foregoing.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- 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. Burndy
 - 2. ERICO
 - 3. ILSCO
 - 4. O-Z Gedney
- B. Source Limitations: Obtain materials and accessories from single source from single manufacturer.

2.02 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.
- B. Comply with CEC.

2.03 GROUND RODS:

- A. 3/4 inch diameter X 10 feet long copper clad steel.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. System Grounding Electrode:
 - 1. Where available on the premises and in accordance with Code requirements, the water piping system and metal building frame shall be bonded together to form a grounding electrode system as described in CEC Article 250.
- B. Ground and bond the electrical system and equipment in accordance with the most stringent of applicable codes but with the requirements herein and on drawings to be the minimum standards.
- C. Provide copper THHN/THWN-2 insulated equipment grounding conductors in all raceways used for electrical power circuits, including conduit, wireway, etc.
- D. The grounding conductors shall be provided whether scheduled or shown on the drawings or not, and if necessary the conduit size shall be increased to accommodate them. These grounding conductors shall be connected to the ground terminals on the device or enclosure at each end of the installation and shall be interconnected with the other ground terminals and conductors to form a continuous wired grounding system throughout the electrical wiring system.
- E. Ground rods: Drive full length into earth with the top 3 inches minimum below grade or underside of slab. Where ground rods cannot be driven vertically to the desired depth below grade, they shall be driven at an angle away from or parallel to the exterior wall. When driven parallel to the wall, the angle shall not exceed 45 degrees. The rod shall penetrate to a depth of permanent ground moisture.
- F. When ground rods cannot be driven because of bedrock at less than 4 feet below grade level, a counterpoise grounding electrode shall be used in place of rods. The counterpoise system shall consist of not less than 50 feet of No. 2 AWG bare tinned copper wire, buried to a depth of at least 18 inches below grade, for each ground rod shown. The conductors shall be run in a straight line.
- G. Connections: Connection to inaccessible ground rods below ground shall be made using exothermic welding devices. Above ground and accessible connections may be made using ground rod clamps or exothermic devices. Multiple bolt silicon bronze connectors, Burndy or O.Z. Electric; or exothermic welded, Burndy, Erico Cadweld products, or equal.
- H. Grounding electrode conductors shall be provided for service equipment and transformers by the Contractor. Utility Company transformer grounding shall be installed per Utility Company requirements. Ground conductor connections to transformer shall be by Utility Company
- I. Flush wall outlets shall have a bonding wire from device ground terminal, or approved mounting screw from strap, to metal box.

3.02 FIELD QUALITY CONTROL

- A. Test each grounding electrode for resistance at the connection point before connecting any wires. Resistance at the grounding electrode shall not exceed the following:

Service entrance equipment: 10 ohms

Interior electrical systems: 25 ohms

Exterior lighting standards: 25 ohms

If the above values are not achieved with the installed system notify the District's representative.

- B. Resistance to ground of the electrode shall be a maximum of 10 ohms. If the resistance is in excess of that specified above, provide one or more ground rods bonded to the electrode described herein until the required resistance is obtained. Space rods a minimum of 10 feet apart. Bonding conductor shall be the same size as the grounding electrode connector. Test the electrode using the "fall of potential" method (described in IEEE No. 142) using a Biddle Earth Megger or equal, calibrated within the previous 12 months. Perform test not less than 48 hours after rainfall. No conductive agents, chemicals, water, etc. shall be applied to lower ground resistance.
- C. Each grounding electrode shall be tested using a ground resistance Megger, or other suitable instrument, in conformance with the manufacturer's directions. Submit a report listing as a minimum the date of testing, name of tester, instrument used, location and type of ground electrode, and resistance in ohms. Submit within 5 days after testing is completed.

END OF SECTION

SECTION 26 05 33

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. For underground raceways and structures refer to Section 26 05 43 "Underground Ducts and Raceways for Electrical Systems".

1.02 SUMMARY

- A. Section Includes:
 - 1. Metal conduits, tubing, and fittings.
 - 2. Nonmetal conduits, tubing, and fittings.
 - 3. Metal wireways and auxiliary gutters.
 - 4. Nonmetal wireways and auxiliary gutters.
 - 5. Surface raceways.
 - 6. Boxes, enclosures, and cabinets.

1.03 DEFINITIONS

- A. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.
- B. EMT: Electrical Metallic Tubing
- C. IMC: Intermediate Metal Conduit
- D. RAC: Rigid Aluminum Conduit
- E. RGS: Rigid Galvanized Steel
- F. RPC: Rigid Plastic Conduit

1.04 QUALITY ASSURANCE

- A. All materials shall be UL listed.

1.05 SUBMITTALS

- A. Product Data
 - 1. Material List: A material list with names of manufacturers, model numbers, and technical information on all equipment proposed.
 - 2. Product technical information sheets for each principal component in the proposed system. Identify by arrow, circle or similar means products being proposed. Submittals consisting of unmodified catalog pages with no markings will be rejected.
 - 3. Weight, dimensions and shipping splits.

4. Equipment operating and service (maintenance) clearances required around the equipment.
- B. Shop Drawings
- C. Test Procedures: A written document detailing the proposed test procedures of the system shall be supplied. These procedures shall include all tests required by the equipment manufacturer and by this specification.
- D. Test Results Report: The results of the execution of the testing procedure, including the items tested or inspected, the date, and by whom.
- E. Operating Sequences: Provide a complete written description of the Sequence of Operation of each of the systems including startup and recovery procedures
- F. Samples: when requested by Architect
- G. Operation and Maintenance (O&M) Manuals: Furnish composite "Systems Operation and Maintenance" manuals in indexed three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain, but not be limited to:
 1. Operational procedures for the overall systems including the "Sequence of Operation".
 2. Test procedures and test results.
 3. Instruction for the proper operation and maintenance of the system.
 4. Factory issued technical, installation, and maintenance manuals.
 5. Factory issued operations and programming (software) manuals.
 6. A replacement parts list complete with part numbers and name, address, and phone number of suppliers used by the Contractor. A spare parts list recommended for purchase by the District shall be included.
 7. All portions of the material list and shop drawings which are not included in the foregoing.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Floor Boxes:
 - a. Hubbell
 - b. Lew
 - c. Steel City
 - d. Russel – Stoll
 - e. Thomas & Betts
 - f. Or equal

2. Wireways:

- a. Hoffman
- b. Nepco
- c. Square D
- d. Or equal

- B. Source Limitations: Obtain materials and accessories from single source from single manufacturer.

2.02 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.

- B. Comply with CEC.

2.03 CONDUITS

A. Acceptable Manufacturers

- 1. Metallic Conduit: Triangle, PWC, Wheeling Steel, Youngstown Sheet & Tube Co., Allied Tube & Conduit Co., Wheatland, or equal.
- 2. Non-Metallic Conduit: Carlon, CertainTeed, Pacific Western, or equal.
- 3. Liquidtight Flexible Conduit: American Brass Co., Columbia Cable and Electric Corp. International Metal Hose, Appleton, or equal.
- 4. Conduit Bodies and Fittings: Appleton Electric, Crouse Hinds, Gedney Electric Mfg. Co., Thomas & Betts, Steel City, or equal.

B. General:

- 1. Types and applications shall be in conformance with Codes and with this specification
- 2. Minimum sizes: 3/4" unless indicated otherwise herein and on drawings.

C. Types:

- 1. RGS and IMC and fittings: Hot dip galvanized. Threaded type. Required for circuits operating at voltages above 600 volts and when required elsewhere herein and on drawings.
- 2. EMT and fittings: Same finish requirements as for RGS. Use permitted only in dry, concealed locations (above suspended ceilings and inside stud walls) and interior exposed locations (10' minimum above floor) where not subject to mechanical damage. Exposed EMT may be used anywhere within electrical rooms regardless of height. Fittings: Liquid tight compression gland type, steel or malleable iron. Steel City #TC715 or T & B #5123 series. Exception: Cast fittings are permitted for 1-1/2" and larger conduits.

3. Flexible steel conduit and fittings: Flexible conduit shall be galvanized steel and shall be used where shown on the plans and to connect conduit systems to motors, direct wired and vibrating equipment, and as a final connection to lighting fixtures in accessible dropped grid type ceilings. Flex shall not be used as a wiring system instead of EMT. Flex shall be used instead of EMT only where EMT would be impossible to use in interior dry frame or stud construction in conformance with codes and ordinances [and where permission is granted upon request, by the District's representative].
4. Flexible conduit shall have a code sized grounding conductor run with it and shall have approved grounding fittings. Where used in damp or wet locations flexible conduit shall be of the liquid tight type with outer neoprene jacket and suitable liquid-tight fittings. Fittings: "Jake" or malleable iron squeeze type.
5. Liquid-tight flexible steel conduit and fittings: Same finish requirements as for rigid steel except PVC jacketed. Use in lieu of standard flexible conduit in damp or wet locations and for connections to motors. Fittings: Appleton "ST" series or American Brass "Sealtite" type U.A
6. RPC and fittings: PVC schedule 40. Use permitted only for underground runs and concealed in masonry walls. Final bends associated with conduit stub-ups to transition to above ground conduits shall be PVC coated rigid galvanized steel. RPC shall conform to NEMA TC 2 and shall be UL listed. Conduit, fittings and solvent cement shall be produced by the same manufacturer and shall be chemically and mechanically compatible.

2.04 WIREWAYS AND WIRING GUTTERS

- A. Construct of galvanized sheet steel which has been primed and given a final coat of grey enamel. Covers shall be hinged and fastened with brass machine screws spaced not more than 12 inches apart. When covers are on the bottom, provide removable wire supports not more than 3 feet apart.

2.05 OUTLET, JUNCTION AND PULL BOXES

- A. Outlet boxes, junction boxes and covers shall be galvanized one-piece pressed steel knockout type. Exception: Exposed conduit boxes shall be cast metal if connected to rigid or intermediate conduit.
- B. The size of each box for light outlets shall be determined by the number of wires or conduits, or size of conduits, entering the box but shall be not less than 4" square and 2-1/8" deep, unless prohibited by structural conditions.
- C. Wall outlet boxes shall be of size and type to suit each individual location. Minimum box size shall be 4-4/16" square by 2-1/8" deep with single gang plaster rings (depth as necessary). Provide blank device plates
- D. All junction boxes on the drawings shall be minimum 4-11/16" square by 2-1/8" deep.
- E. Provide wall mounted boxes such as switch, receptacle, telephone, junction, etc., with manufactured "far side box supports", which shall be in contact with the gypsum board surface behind the box.

- F. Use approved factory-made knockout seals in all boxes where knockouts are not intact.
- G. Use offset bar hangers fitted with fixture studs to support outlet boxes in stud partitions and in furred or plastered ceilings.
- H. Outlets for wall mounted telephones shall be an outlet box which is securely fastened to structure.
- I. Nonmetallic Floor Boxes: Rectangular.
 - 1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Nonmetallic floor boxes shall be gangable and adjustable.
 - 3. Metal threaded inserts shall be provided for attachment of devices and trim plates.
 - 4. Multi-gang floor box shall be used where indicated on the drawings.
 - 5. There shall be minimum of 1-1/4 inch external height adjustment and minimum 3/8 inch internal final adjustment. Top flange shall be rectangular and adjusted flush with the finished floor.
 - 6. Provide brass tile flanges. Cover shall be brass duplex flap type, equal to Hubbell #S3825 or equal for power, and brass 2-1/8 inch single type, equal to Hubbell #S2825 or equal, for telephone, signal and data systems, and Soundolier 'MRB' or equal series for projector and microphone jacks. Single and ganged floor boxes in carpeted areas shall be provided with clear polycarbonate carpet flange.

PART 3 - EXECUTION

3.01 DEMOLITION

- A. Where an outlet, device or item of electrical equipment is shown to be removed, the entire installation, including boxes and conduit, shall be removed unless otherwise indicated.
- B. Where the structure, finish, fixture, outlet, circuit or equipment is damaged or left incomplete or unworkable due to demolition work, it shall be patched, repaired, replaced, rerouted or relocated as conditions require and as directed by the Architect.

3.02 INSTALLATION – GENERAL

- A. Continuously check the work of the other Divisions to prevent any interference between the various installations. Should structural difficulties or work of other Divisions prevent the routing of conduit as indicated on the drawings, make necessary deviations there from as directed by the District's representative.
- B. Provide the empty raceway rough-in and the power for the following systems as indicated on drawings and described herein.
 - 1. Telephone/Voice/Data

2. Fire Detection and Alarm
 3. Access Control
- C. Installation of conduit, termination of conduit in terminal closets, and other work necessary for the system rough-in, shall comply with the requirements of communication system suppliers.

3.03 CONDUIT INSTALLATION

- A. Telephone/Voice/Data conduit bends shall be as follows:
1. 3/4" and 1" conduit: 12" minimum radius bends,
 2. 1-1/4" conduit, 18-in. minimum radius bend.
 3. Conduit sizes shown on the drawings are designed so that each separate run will not have more than two 90° bends. If more than two ninety degree bends are required, install long sweep bends. Cast conduit bodies or pull boxes, if required, will not be permitted until the type and location are submitted for approval.
- B. Conduit installed in concrete work shall be carefully laid and rigidly supported in the forms in such a manner as to provide proper clearance so that all boxes and outlets will be in exact locations after concrete has set and forms have been removed.
- C. Concrete slabs on grade: Conduit shall not be installed in slab on grade.
- D. Route conduit so as to clear beams, plates, footings and structural members, whether or not indicated on the plans. Do not run conduit through any structural member of the building, except as specifically directed by the Owner's representative.
- E. Where conduit penetrates a fire rated separation, any of the following packing methods may be used to restore the integrity of the separation if Code approved: cement, mineral fiber sprayed with a flame retardant coating, or Dow Corning 3 -6548 RTV silicon foam, 3M caulk #CP25, 3M putty #303, or equal. Seal shall be water tight and shall be accomplished prior to wire pulling.
- F. Do not run conduit closer than 6 inches to any uninsulated hot water or steam pipe, heater flue or vent. If pipe is insulated, the clearance may be reduced to 2 inches.
- G. Provide cast conduit bodies (condulets) for exposed runs of conduit where junction, bends or offset are required, whether such condulets are indicated on the plans or not. No bends are permitted around corners, beams, wall or equipment. No running threads are permitted. Run a die over factory threads to ensure that they are clean and free from all coating material and that good metallic contact with the fittings is obtained. Paint the exposed portion of field cut threads with a suitable zinc rich paint.
- H. Upon completion of each run of conduit, test the run and clear it of all obstructions. Plug each conduit end with conduit pennies and bushings or manufacturers seals until ready for pulling wire. Provide a 200 pound test nylon or polypropylene pull rope in each empty conduit. Tie off rope at each end and provide an identification tag on rope at each end indicating the room and outlet designation of its destination (as directed by District's representative).
- I. Where panelboards and cabinets are installed flush in walls, extend empty conduits from panel to an accessible space above or as indicated on plans. Provide a minimum of one

3/4" conduit for each three single pole spare circuit breakers or spaces, or equivalent, but not less than three conduits.

3.04 CONDUIT INSTALLATION – ABOVE GRADE

- A. All conduit above grade or inside of a structure shall be metallic, except in masonry and concrete walls RPC may be used.
- B. Run conduit concealed, except as otherwise indicated.
- C. Run exposed conduit parallel with or at right angles to walls or as directed by the District's representative.
- D. Where conduits are placed in partitions necessitating cutting of any structural member, provide supports as directed by Owner's representative in accordance with applicable structural requirements.
- E. Locate conduit so as not to obstruct access or service to equipment.
- F. Conduit passing through the roof: Flash and counter-flash in accordance with architectural drawings and specifications. Method shall be compatible with roofing system and acceptable to the Owner's representative. Roof top conduits shall be rigid steel and shall be neatly grouped and installed parallel to the building lines. Support conduit on minimum 2" x 4" redwood or equal sleepers at maximum 5' spacing.
- G. Conduit 1" and smaller over metal channel for lath and plaster or acoustical ceilings shall be tied to the supporting channels with 12 gauge galvanized tie wire spaced at a maximum of 10 feet intervals. Conduits shall not obstruct accessibility of ceiling or removal of panels. Do not use ceiling wires for support. Support exposed conduit 1" and smaller from building with T & B, or equal, pipe straps spaced at a maximum of 10 feet intervals. Attach supports with machine screws, nuts and lock washers in metal; wood screws in wood; and expansion shields or inserts in masonry or concrete. Perforated strap iron and nail straps shall not be used. Conduits larger than 1" shall be suspended on pipe racks with Grinnell No. 107B, or equal, split ring hangers and rods from concrete inserts. Conduits supported by unistrut trapezes shall be attached with straps.
- H. RGS shall be installed in interior wet locations, exposed exterior locations, and wherever specifically shown. Where installed in exterior locations, RGS and fittings shall be PVC coated for corrosion protection. Conduit, from slab to bottom of surface mounted panelboards, distribution panels, device outlet boxes, and terminal cabinets, where exposed, shall be RGS. Conduit concealed in wall from slab to flush mounted panels, distribution panels, terminal cabinets, and all device outlet boxes for all systems shall be EMT except to devices mounted at 36" or less in which case flexible conduit may be used. Contractor shall be allowed a dimension of 3" above slab to make transition from PVC to EMT, flex or rigid steel as allowed above.
- I. Conduits which cross building expansion joints or seismic joints shall be provided with expansion/deflection couplings, Crouse Hinds "XD" Series, or equal where building movement exceeds the rating of expansion/deflection couplings, provide suitable flexible metallic conduit installation across joint.
- J. The ends of all underground conduits entering buildings shall be capped or sealed with acceptable compound, such as Crouse Hinds "Chico A", after installation of wire. Cap empty conduit stub-outs at both ends.

3.05 WIREWAYS AND WIRING GUTTERS

- A. Sections shall be securely attached to each other and to cabinets, boxes, or duct to insure ground continuity. Provide copper equipment grounding conductors throughout the wireway system. Securely attached or support the wireway or gutter from the building structure at points no more than 4 feet apart. Size shall be as indicated on drawings unless larger is required to conform to CEC. When suspended from roof or ceiling, the support spacing shall be not more than 4 feet and 3/8 inch diameter rods shall be used. When attached to wall, use expansion anchors in masonry and concrete, sheet metal screws supplemented with toggle bolts in drywall with metal studs, and wood screws supplemented with toggle bolts in drywall with wood studs.
- B. Power gutter assemblies: Mount gutter to a 3/4 inch plywood backboard. Gutter and backboard shall be sized to accommodate the equipment. Arrange equipment neatly and symmetrically on backboard.

3.06 OUTLET, JUNCTION AND PULL BOXES

- A. Boxes shall be labeled with a felt tipped pen indicating the designations of the circuits they contain (panel, circuit #, etc.). Locate the labeling text for easy reading if exposed or above ceiling or below access flooring.
- B. Provide pull boxes and junction boxes where indicated on plans or where required by Code. Size to properly accommodate conductors with Code requirements as minimum. When necessary pull and junction boxes are not indicated on drawings and are to be placed in a public space, coordinate the location with the Owner's representative. Boxes of outlet box size which are in public spaces shall be flush mounted and shall have single gang ring and blank device plate painted to match adjacent surface.
- C. In all conference rooms, audio labs, office walls common to printer bars, copy rooms, mechanical rooms and similar spaces and also where sound isolation walls are indicated on architectural drawings, provide sound pads (acoustical noise transfer reduction material) applied to all boxes, Dottie 68 type or equal.
- D. For local switch outlets, provide 4 inch pressed steel boxes with switch plaster rings for one or two gangs. Where 2 gang, 20 ampere or larger switches occur, provide 4-11/16 inch square boxes with switch plaster rings.
- E. For convenience outlets, etc., provide 4 inch square pressed steel boxes, or larger if necessary, with single gang plaster rings.
- F. In masonry or concrete construction waterproof boxes manufactured for that purpose shall be used.

END OF SECTION

SECTION 26 05 43

UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Direct-buried conduit, ducts, and duct accessories.
 - 2. Concrete-encased conduit, ducts, and duct accessories.
 - 3. Pullboxes
 - 4. Handholes

1.03 DEFINITIONS

- A. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.

1.04 QUALITY ASSURANCE

- A. Comply with CEC.

1.05 SUBMITTALS

- A. Product Data
 - 1. Material List: A material list with names of manufacturers, model numbers, and technical information on all equipment proposed.
 - 2. Product technical information sheets for each principal component in the proposed system. Identify by arrow, circle or similar means products being proposed. Submittals consisting of unmodified catalog pages with no markings will be rejected.
 - 3. Weight, dimensions and shipping splits.
 - 4. Equipment operating and service (maintenance) clearances required around the equipment.
- B. Shop Drawings
 - 1. Precast or Factory-Fabricated Underground Utility Structures:
 - a. Include plans, elevations, sections, details, attachments to other work, and accessories.
 - b. Include duct entry provisions, including locations and duct sizes.

- c. Include reinforcement details.
 - d. Include frame and cover design.
 - e. Include grounding details.
 - f. Include dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
 - g. Include joint details.
- C. Test Procedures: A written document detailing the proposed test procedures of the system shall be supplied. These procedures shall include all tests required by the equipment manufacturer and by this specification.
- D. Test Results Report: The results of the execution of the testing procedure, including the items tested or inspected, the date, and by whom.
- E. Operating Sequences: Provide a complete written description of the Sequence of Operation of each of the systems including startup and recovery procedures
- F. Samples: when requested by Architect
- G. Operation and Maintenance (O&M) Manuals: Furnish composite "Systems Operation and Maintenance" manuals in indexed three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain, but not be limited to:
- 1. Operational procedures for the overall systems including the "Sequence of Operation".
 - 2. Test procedures and test results.
 - 3. Instruction for the proper operation and maintenance of the system.
 - 4. Factory issued technical, installation, and maintenance manuals.
 - 5. Factory issued operations and programming (software) manuals.
 - 6. A replacement parts list complete with part numbers and name, address, and phone number of suppliers used by the Contractor. A spare parts list recommended for purchase by the District shall be included.
 - 7. All portions of the material list and shop drawings which are not included in the foregoing.

1.06 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Handhole cover bolts: Equal to 200 percent of quantity installed for each size and type, but no fewer than twelve of each size and type.
2. Handhole bolt socket-wrench socket: Furnish two (2) for each bolt head size and type, 1/2 inch drive.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- 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. Underground Pullboxes and Handholes
 - a. Newbasis
 - b. Jensen Precast
 - c. Utility Vault Co.
 - d. San Diego Precast
 - e. Or equal.
 2. Cable Supports:
 - a. OZ
 - b. PLM
 - c. Or equal
- B. Source Limitations: Obtain materials and accessories from single source from single manufacturer.

2.02 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.

2.03 CONCRETE WORK

- A. Concrete for work under this Section shall be as specified in Division 3.
- B. Concrete involving a serving Utility's equipment or systems shall conform to the requirements of the Utility.

2.04 CONDUIT

- A. RNC: NEMA TC 2, Type EPC-40-PVC and Type EPC-80-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.05 UNDERGROUND PULLBOXES

- A. Pullboxes (less than 24" X 36") for exterior underground use shall be reinforced, precast, concrete electrical type.
- B. Boxes shall consist of a body, cover, extension and base, with clear interior dimensions as shown on the drawings.

- C. Covers shall be concrete bolt down traffic type. Concrete covers shall fit flush and without rocking. Chipped, cracked, or badly fitting covers will not be acceptable. All bolts shall be tamper resistant stainless steel.
- D. Mark all covers with permanent raised or depressed letters reading "Electrical", "Parking Lighting", "Ground Rod", "Signal" or applicable designation unless noted otherwise on drawings. No abbreviations.

2.06 UNDERGROUND HANDHOLES

- A. Pullboxes (24" x 36" or larger) for exterior underground use shall be reinforced, precast, concrete electrical type.
- B. Boxes shall consist of a body, cover, extensions, and base, with clear interior dimensions as shown on the drawings.
- C. Covers for 24" X 36" pull boxes shall be 1 piece, bolt-down type. Covers for 48" X 48" or larger pull boxes shall be two piece torsion hinged type. Covers shall be parkway or traffic as called for on drawings with heavy-duty galvanized steel checkered plate with angle frame. All exposed steel shall be galvanized. All bolts shall be tamper resistant Type 304 stainless steel. Mark all covers with permanent raised or depressed letters reading "Electrical", "Signal", or applicable designation unless otherwise noted. No abbreviations.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Pullboxes, handholes and ducts shall be assembled and installed in strict conformance with the manufacturer's instructions.
- B. Coordinate elevations of ducts and duct-bank entrances into handholes and pullboxes with final locations and profiles of ducts and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Architect.
- C. Pullboxes with open bottoms shall be set on a minimum of 12 inches deep sand base to allow for drainage. Handhole base sections shall be set on a minimum of 6 inches compacted and leveled rock or sand to ensure even distribution of soil pressure on base. Top of covers shall be flush with final grade or paving and shall be perfectly level. All covers within pedestrian paths of travel shall be ADA compliant.
- D. A preformed joint sealing compound of non-hardening mastic furnished by the handhole manufacturer shall be placed in the grooves of the base and body sections to seal the sections together watertight. Joints shall be carefully cleaned before sealing.
- E. Concrete encased ducts connecting to handholes shall be constructed to have a tapered section adjacent to the handhole to provide shear strength. Vibrators shall be used when

this portion of the envelope is poured to assure a seal between the envelope and the wall of the handhole.

- F. Provide end bells for all duct terminations in pullboxes and handholes.
- G. Backfilling around structures shall consist of earth, loam, sand clay, or sand and gravel, free from large clods of earth or stones over 1 inch in size. Backfill materials shall be placed symmetrically on all sides in loose layers not more than 9 inches deep. Each layer shall be moistened, if necessary, and compacted with mechanical or hand tampers to 90% compaction. Surfaces disturbed during the installation of pullboxes and handholes shall be replaced.
- H. Pullboxes and handholes shall be located away from pedestrian and vehicular paths of travel wherever possible.
- I. In locations where water will collect in the pullbox or handhole, provide a drain connected to the site storm drainage system.
- J. Under no circumstances shall the rim elevation of the pullbox or handhole nearest to the point of entry of conduits to a building or electrical switchboard, panel or other enclosure be above the floor level of the building or enclosure.
- K. Metallic covers of pullboxes and handholes shall be bonded to the equipment grounding conductor. Bonding conductor shall be minimum 6 AWG insulated copper with sufficient slack to allow removal of the cover.
- L. After installation, handholes and pullboxes shall be cleaned of dirt, sand, and debris and the covers sets in place. Pull ropes leaving ducts shall be suitably tagged to allow future identification and use. Location of duct entry shall be marked clearly on as built plans for pullboxes and handholes.

3.02 UNDERGROUND DUCT INSTALLATION

- A. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-40 -PVC, in concrete-encased duct bank unless otherwise indicated.
- B. Ducts for Electrical Branch Circuits: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank unless otherwise indicated.
- C. Underground Ducts Crossing Driveways and Roadways: RNC, NEMA Type EPC-40-PVC, encased in reinforced concrete.
- D. Install ducts according to NEMA TCB 2.
- E. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes, to drain in both directions.
- F. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches], both horizontally and vertically, at other locations unless otherwise indicated.

- G. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.
- H. Concrete-Encased Ducts: Support ducts on duct separators.
1. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Section 312000 "Earth Moving" for pipes less than 6 inches in nominal diameter.
 2. Width: Excavate trench 12 inches wider than duct bank on each side.
 3. Width: Excavate trench 3 inches wider than duct bank on each side.
 4. Depth: Install top of duct bank at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 30 inches below finished grade in deliberate traffic paths for vehicles unless otherwise indicated.
 5. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
 6. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than four spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
 7. Minimum Space between Ducts: 3 inches between ducts and exterior envelope wall, 2 inches between ducts for like services, and 12 inches between power and signal ducts.
 8. Elbows: Use manufactured duct elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run unless otherwise indicated. Extend concrete encasement throughout length of elbow.
 9. Elbows: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
 - b. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.
 10. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.

11. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
12. Concrete Cover: Install a minimum of 3 inches of concrete cover at top and bottom, and a minimum of 2 inches on each side of duct bank.
13. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
 - a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
 - b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing-rod dowels extending a minimum of 18 inches into concrete on both sides of joint near corners of envelope.
14. Pouring Concrete: Comply with requirements in "Concrete Placement" Article in Section 033000 "Cast-in-Place Concrete." Place concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.

I. Direct-Buried Duct Banks:

1. Excavate trench bottom to provide firm and uniform support for duct bank. Comply with requirements in Section 312000 "Earth Moving" for preparation of trench bottoms for pipes less than 6 inches in nominal diameter.
2. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
3. Space separators close enough to prevent sagging and deforming of ducts, with not less than five spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches between tiers.
4. Depth: Install top of duct bank at least 36 inches below finished grade unless otherwise indicated.
5. Set elevation of bottom of duct bank below frost line.
6. Install ducts with a minimum of 3 inches between ducts for like services and 6 inches between power and signal ducts.

7. Elbows: Install manufactured duct elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
8. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
 - b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
9. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to 4 inches over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction. Comply with requirements in Section 312000 "Earth Moving" for installation of backfill materials.
 - a. Place minimum 3 inches of sand as a bed for duct bank. Place sand to a minimum of 6 inches above top level of duct bank.
 - b. Place minimum 6 inches of engineered fill above concrete encasement of duct bank.

J. Pulling Cord: Install 100-lbf- test nylon cord in empty ducts.

K. Warning Tape: Bury warning tape approximately 12 inches above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches of centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

Conduit Location Markers: Conduits stubbed or capped off underground shall have their location identified with a concrete marker 6" x 6" x 12" high with a flush brass plate set in the 6" face. Identification of the conduit shall be stamped or engraved into the plate and the marker set flush with finished grade. Show exact location of markers and identification markings on as built drawings. Submit data sheets as specified under "SUBMITTALS".

3.03 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections and prepare test reports:
 1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.

2. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.

END OF SECTION

SECTION 26 05 48

VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Work in this section includes providing materials, and equipment for the installation of vibration isolation mounts, brackets, seismic restraints, flexible connectors, and conduit isolation hangers. The installation shall be complete in every respect, tested, and adjusted to be in first class working order.
- B. Related sections include the following:
 - I. Section 26 05 33 "Raceways and Boxes for Electrical Systems."

1.03 DEFINITIONS

- A. CBC: California Building Code (CCR Title 24, Part 2)

1.04 GENERAL REQUIREMENTS

- A. Comply with CBC and details on the drawings.
- B. Comply with ASCE/SEI 7 where referenced by CBC.
- C. Seismic-Restraint Loading: ASCE/SEI 7 Seismic Design Category, Component Importance Factor and Occupancy Category as indicated on drawings.
- D. Consult vibration isolation schedule for types and static deflections of isolators.
- E. Specific items of equipment and accessories are listed in specifications and/or shown on drawings. Where specific manufacturer's model numbers are referenced, it shall be considered that the manufacturer's current and complete specifications are included herein in full.
- F. Provide vibration isolators of appropriate sizes and distribution to meet specified deflection requirements. For typical equipment units, provide not fewer than four isolators.
- G. Take equipment weight into account and assure that all isolators for any equipment unit deflect uniformly and without "short-circuiting" when the unit is operating. Uniformly means that the maximum and the minimum isolator deflection shall be within 5% of the specified average deflection.
- H. The static deflections specified are based on the anticipated equipment characteristics. In the event the equipment proposed by the Contractor has characteristics other than those indicated, the static deflection shall be re-evaluated and the proper mountings and other devices shall be provided.

- I. Provide seismic restraints on all vibration isolated equipment and components. Restraints shall resist a seismic acceleration in any direction of at least 0.5 G without damage to equipment, building or mounts. Restraints shall not short-circuit vibration isolators during normal operation. Generally, there shall be as many seismic restraints as there are vibration isolators on a piece of equipment and restraints and isolators shall be paired together.
- J. The Contractor shall rigorously avoid short-circuiting to the building any vibration isolated piece of equipment, conduit or other component. Short-circuits with or via rigid braces, rigid sleeves, framing, etc. all shall be avoided. The Contractor shall coordinate among trades so as to prevent the short-circuiting of any vibration isolation system and shall bring any unresolved conflicts to the Owner's representative and attention.
- K. Provide all incidental equipment or parts needed to meet the requirements stated, even if not specified or shown on drawings, without claim for additional payment.

1.05 SUBMITTALS

- A. Refer to related sections elsewhere for submittal procedural instructions.
- B. Submit and obtain approval of shop drawings before ordering components or materials.
- C. Submit shop drawings including the following:
 - 1. Location and type of vibration isolations.
 - 2. A complete tabulation showing for each vibration isolator:
 - 3. The design load.
 - 4. The static deflection expected under the design load.
 - 5. Specified minimum static deflection.
 - 6. The additional deflection to solid under design load.
 - 7. The ratio of spring height under design load to spring diameter.
- D. Details of seismic restraints, steel brackets, steel rails, steel base frames, and concrete inertia bases showing all steel work, reinforcing, and vibration isolator and seismic restraint mounting attachment methods.
- E. Special details at large scale and all other necessary information to convey complete understanding of the work to be provided.
- F. Calculations by a professional structural engineer licensed in the state of California, showing that all seismic restraints, bolts, cables, and associated components will conform with the requirements of California Building Code, will comply with other applicable local codes.
- G. Submission of samples may be requested for some or all vibration isolation devices. After approval, sample will be returned for installation at the job. All costs associated with submission and return (but not review) of sample shall be borne by the Contractor.
- H. Submit, at the time of shipment, a certified statement by the galvanizer indicating conformity of the galvanizing with ASTM specifications for vibration isolators that are located out of doors.

- I. At completion of installation, submit the following documents. Submission of these documents must be complete before final acceptance of vibration isolation systems is given.
- J. A complete tabulation showing for each vibration isolator:
 - 1. The actual static deflection measured at the project site and the specified minimum static deflection.
 - 2. A report certifying that each piece of isolated equipment or equipment component (conduit, etc.) is not short-circuited by any means.

1.06 SUBSTITUTIONS

- A. Substitutions of equal equipment beyond the alternates listed will be permitted only with the written permission of the District's representative. Accompany each request for acceptance of substitute equipment with manufacturer's certified data providing the equivalence of the proposed substitute in quality and performance. The District's representative shall be the final judge of the validity of the data submitted.

PART 2 - PRODUCTS

2.01 MATERIALS, COMPONENTS AND PARTS

- A. All materials, components, and parts shall be new.
- B. Vibration isolators, and seismic restraints shall be the products of an experienced and approved manufacturer. Insofar as possible, they shall be the product of a single manufacturer.
- C. All metal parts of vibration isolators installed out of doors shall be hot-dip galvanized after fabrication. Galvanizing shall comply with ASTM A 123, A 153, and A 386 as applicable.
- D. All elastomeric mounts, pads, bushings, sleeves, washers, etc., shall have a Shore-A hardness of 30 to 50 durometer after minimum aging of 20 days or corresponding oven-aging.

2.02 ACCEPTABLE MANUFACTURERS

- A. Amber/Booth Company, A/B, Houston, Texas
- B. Mason Industries Inc., Mason, Los Angeles, California
- C. Kinetics Noise Control Inc, Dublin, Ohio

2.03 VIBRATION ISOLATION MOUNTS

- A. Mount P1 - Single or Multiple Extra Thick Neoprene Pad(s) and Bearing Plate(s).
- B. Neoprene pad shall be waffled, ¾ inch thick, 30 to 40 or 50 durometer, as scheduled, with a minimum 1/16 inch thick steel bearing plate on top. Pad areas shall be selected so no more than 15% and no less than 10% deflection occurs due to the supported load.

- C. Provide single or multiple pads and plates in series as specified with 1/16" thick steel shim between layers.
- D. Mount P1 shall be the following or approval equal
 - 1. Mason Super W + Plate(s) or SWM
 - 2. Mount B1 - Neoprene-in-Shear Base Mount
- E. Neoprene isolators shall be double-deflection neoprene-in-shear type with steel-reinforced base. All metal surfaces shall be covered with neoprene. The top and bottom surfaces shall be ribbed. Bolt holes shall be supplied in the base and the top shall have a threaded fastener. Neoprene no harder than 50 durometer.
- F. Mount B1 shall be of the following or approved equal:
 - 1. A/B RVD
 - 2. Mason ND
 - 3. Kinetics RD
- G. Mount B1EQ - Neoprene Mount with Seismic Restraint
- H. A neoprene isolator with concentric steel elements separated by neoprene no harder than 50 durometer. Mount capable of acting in tension, compression or shear.
- I. Mount B1EQ shall be the following or approved equal:
 - 1. Mason RAA, RBA or RCA

2.04 EQUIPMENT BASES

- A. Equipment shall have an integral casing or base frame that is adequately strong to be supported directly on vibration isolators without deforming the casing or frame or affecting equipment or isolator operation. Place vibration isolators directly under equipment or connect steel height-saving brackets to the sides of the equipment and place isolators under brackets. Equipment manufacturer shall approve such mounting.

2.05 SEISMIC RESTRAINTS

- A. EQR1 - Floor-Mounted Equipment on Isolation Mounts without Seismic Restraint Housing.
- B. Separate earthquake restraints shall be provided for all floor-mounted equipment on vibration isolation mounts that do not include seismic restraint housings. Provide a minimum of four all-directional earthquake restraints that are located as close to the vibration isolators as possible to facilitate attachment of both to the base and the structure. The restraints shall consist of interlocking steel members restrained by a shock-absorbent neoprene bushing. Bushing shall be a minimum of 1/4" thick. Restraints shall be manufactured with an air gap between hard and resilient material of 3/16 to 1/4". Snubbers shall be installed with factory-set clearances. Snubber end shall be removable to allow inspection of internal clearances. Snubber bushing shall be rotated during and after installation to insure no short circuits exist. Restraints shall comply with the CBC and shall resist a seismic acceleration in any direction of at least 0.5 G without damage to themselves, the building or the equipment.
- C. Earthquake restraints shall be the following or an approved equal:

1. Mason Z-1011 or Z-1225

2.06 FLEXIBLE CONNECTIONS

- A. Make flexible electrical connections to all vibrating equipment so as to prevent any vibration transfer to the building.
- B. Alternate A
 1. Employ flexible metallic conduit installed grossly slack. Support flexible metallic conduit on both sides of slack portion per CEC.
- C. Alternate B
 1. Employ flexible expansion/deflection conduit couplings sized for the application (1" to 6" diameters available). Coupling to have flexible and watertight outer jacket, inner grounding strap, flexible plastic inner sleeve to maintain smooth wireway, and end hubs with threads to fit standard threaded metal conduit.
 2. Coupling shall be XD Xpansion/Deflection Coupling by Crouse-Hinds of Syracuse, New York, or Type DF Expansion and Deflection Fitting by Spring City Electrical Mfg. Co. of Spring City, Pennsylvania.

PART 3 - EXECUTION

3.01 GENERAL

- A. The Contractor shall provide the vibration isolation devices, seismic restraints, and related materials as specified herein.
- B. The Contractor shall not install any conduit that makes rigid contact with the "building" unless it is approved in this specification or by the Owner's representative. "Building" includes, but is not limited to, roofs, floors, beams, columns, walls, partitions, ceilings, studs, ceiling framing and suspension systems.
- C. Prior to installation, the Contractor shall bring to the Owner's representative attention any conflicts between trades that will result in unavoidable rigid contact of conduit with the building due to inadequate space or other unforeseen conditions. Corrective work after installation, necessitated by unresolved conflicts before installation, shall be at the Contractor's expense.
- D. Prior to installation, the Contractor shall bring to the Owner's representative attention any discrepancies between the specifications and field conditions or any charges required due to specific equipment selection. Corrective work after installation, necessitated by unreported discrepancies or changes, shall be at the Contractor's expense.
- E. The Contractor shall obtain written and/or instructions from the vibration isolation manufacturer as to the proper installation and adjustment of vibration isolation devices; alternatively, the equipment may be installed by the vibration isolation manufacturer.
- F. No equipment unit shall bear directly on or be suspended from vibration isolators or brackets unless its own frame or casing is suitable rigid to span between isolators without

any significant or noticeable deformation and such support is approved by the manufacturer.

- G. Unless otherwise indicated, a minimum clearance of 1" shall be provided between the top of a housekeeping pad or floor or roof and the underside of an equipment unit or steel base frame or concrete inertia block that is vibration-isolated. This space shall be cleaned thoroughly of all dirt and debris.
- H. A written report shall be submitted to the Owner's representative covering all base-mounted equipment and stating that required floor-base clearances have been achieved and that the intervening spaces are clean and free of any material that could short-circuit vibration isolators.
- I. After each equipment unit installation is complete and under full operational load, vibration isolators shall be adjusted so that loads are transferred to them and away from temporary blocking washers and shims. Blocks and shims then shall be removed and used as gauges to judge required clearances. Washers shall be moved away.
- J. Inspect all vibration-isolated equipment, coordinate the work of all involved trades, and see the vibration isolators are not short-circuits. Also, ensure that for hanger isolators and their rods or wires do not touch any other hung building components especially ceiling systems.
- K. Where "conduit systems" are required to be vibration-isolated in a certain room or for a certain distance from an equipment unit, "conduit systems" shall include all conduit, and connected hardware.
- L. Space all vibration-isolated equipment and isolated components and all vibration isolators (including rods and wires) so as to be entirely free of any contact with any building element in any reasonable operating position.
- M. Size, select, and install all seismic restraints so as to resist seismic forces from the building in any direction without damage to equipment, isolators, restraints, or building. Restraints shall not short-circuit vibration isolators during normal operation. Restraints shall comply with the California Building Code and any local codes and shall resist an acceleration of at least 0.5 G.

3.02 SPECIFIC EQUIPMENT

- A. Utility Transformer:
 - 1. Can be hard-mounted to a separate concrete pad provided.

B. Remote and Smaller Building Transformers:

1. UNDER 100kVA: Isolate on Type P-1 pads sized (with appropriate bearing areas) for 0.10" m.s.d. Provide Type EQR1 seismic restraint. Provide flexible conduit connections to all transformers.
2. OVER 100kVA: Isolate on Type B1 or B1EQ mounts providing 0.35" m.s.d. Provide Type EQR1 seismic restraints. Provide flexible conduit connections to all transformers.
- 3.

3.03 SEISMIC RESTRAINTS

- A. All rigidly or resiliently installed equipment, and conduits shall be capable of receiving a seismic input from the building in any direction on the equipment center of gravity without damaging the buildings, equipment or mounting system.
- B. All installations shall be inspected and approved by the Owner's representative for adequate seismic restraint and to assure that such does not short-circuit vibration isolators during normal operation. Adjustments, as reasonably required, shall be made by the Contractor at no expense to the Owner.
- C. All vibration isolators and seismic restraints shall be suitably secured to appropriate structure so that the fastenings and structure can handle the seismic load.

3.04 CONNECTIONS TO EQUIPMENT

- A. Make flexible electrical connections to all vibrating equipment.
 1. Alternate A
 - a. Install flexible conduit in a grossly slack, shallow "U" form. Flexible conduit shall be at least 3 feet or 20 diameters long, whichever is longer.
 2. Alternate B
 - a. The flexible coupling shall be free of any nearby building construction and shall be installed slack and free of strain in any direction.

3.05 FIELD INSPECTIONS AND TESTS

- A. Upon completion of the work, the District's representative will carry out an inspection of the project and of final project record documents and will inform the installing contractor of any further work that must be completed. Make all adjustments as directed by the District's representative that result from this inspection. This work shall be done before final acceptance of vibration isolation systems is given.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes:
 - 1. Identification of fire alarm raceways
 - 2. Identification of power and control cables
 - 3. Identification of conductors
 - 4. Identification of wiring device faceplates
 - 5. Underground line warning tape

1.03 DEFINITIONS

- A. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.

1.04 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 "Scheme for the Identification of Piping Systems."
- B. Comply with CEC.
- C. Comply with 29 CFR 1910.144 "Safety color code for marking physical hazards" and 29 CFR 1910.145 "Specifications for accident prevention signs and tags."
- D. Comply with ANSI Z535.4 "Product Safety Signs and Labels"
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969 "Marking and Labeling Systems."

1.05 SUBMITTALS

- A. Product Data
 - 1. Material List and Manufacturer's Literature
- B. Samples: when requested by Architect.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Source Limitations: Obtain materials and accessories from single source from single manufacturer.

2.02 IDENTIFICATION SYSTEMS

- A. Nameplates

1. Provide nameplates indicating the equipment designation for safety switches and individually mounted breakers, starters, remote control switches and similar items. For indoor locations provide tape nameplates (Kroy, Brother, Weber or equal). For outdoor locations provide laminated black-white-black Bakelite or phenolic plastic with 3/16" high lettering engraved through the outer covering. Affix with small self-tapping cadmium plated machine screws, or a durable, waterproof, heat and sun resistant adhesive appropriate to the purpose. The text shall be spaced away from each end so the screw heads do not overlap the text.
2. Provide nameplates as required by other Sections. Nameplates shall be laminated black-white-black bakelite or phenolic plastic with 3/16" high lettering engraved through the outer covering except where specifically described otherwise. Affix with small self-tapping cadmium plated machine screws appropriate to the purpose (no rivets or glue). The text shall be spaced away from each end so the screw heads do not overlap the text. The screws shall not project beyond the backside face of panelboard doors.
3. Engrave as indicated on drawings or herein. If not indicated, the engraving should describe the equipment served.

- B. Underground Warning Tape: Tape shall be polyethylene plastic manufactured specifically for warning and identification of all buried utility lines. Tape shall be of the type provided in rolls, 6" minimum width, color coded for electric lines (red), and communications (orange) with warning and identification imprinted in bold black letters continuously and repeatedly over entire tape length. Tape shall consist of top and bottom layers of B 721 polyethylene or polyester with a center metallic foil core suitable for locating by a conventional detector at the specified depth. Tape shall be by Thor Enterprises, Brady, Seton, or equal. Submit data sheets as specified under "SUBMITTALS".

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Device Plates

1. Provide switch and device plates with engraved designations wherever called for by words, set off in quotation marks near a switch location, or by symbol. If inscription is not detailed on drawings request it from the Owner's representative. Engraving shall be in 1/8" high block type letters filled with black enamel.

2. Each switch, receptacle device, etc. which is installed in an outlet box with coverplate shall have the panel and circuit number engraved with 1/8" high black filled lettering at top of cover plate.

B. Conduit

1. All Fire Alarm system conduits shall have a 2 inch wide band of red paint every 10 feet along the length.

C. Wire Color Coding

1. Insulation for wires No. 6 and smaller shall be factory color coded and for larger sizes where available from the factory. When factory color is not available provide 1" band of colored pressure sensitive tape at each splice and termination point. Colors shall be consistent throughout the respective system and shall be identified as follows.

System	A - Phase	B - Phase	C - Phase	Neutral	Ground
208Y/120V 3Ø 4W	Black	Red	Blue	White	Green
480Y/277V 3Ø 4W	Brown	Orange	Yellow	Grey	Green

2. Isolated ground for conductors system shall be green with a yellow stripe or green marked with yellow tape.
3. Control, low voltage, and other systems shall have distinctive coloring different from above.
4. Control Circuits:

Hot Lead (usually to stop pushbutton)	Red
Common return	Yellow
Main coil (usually to start pushbutton)	Brown
Reset coil	Blue
Trip coil	Orange

D. Conductor Color Coding

1. All branch circuit conductors shall have their circuit numbers identified with tape labels on each phase conductor. Identification shall be provided at each outlet box, junction box, panelboard, contactor cabinet, or similar location.

E. Nameplates

1. Engraved nameplates shall be provided on each power and communications system feeders in underground pull boxes. Nameplates shall be fastened to feeders with plastic tie wrap. Description shall indicate origin voltage and destination of feeder, i.e.: "From MSB to Panel HZA voltage, 480Y/277 volts". This same tagging method shall be applied to all pull ropes in empty spare conduits. Tags for pull ropes shall include origin and destination of each conduit.
2. All conductors or signal cables left unconnected shall be identified by labeling with their intended use, circuit number, or other suitable information. All power and communications conductors or cables shall tape identified denoting circuit or zone numbers with tape type labels on each conductor of circuit or cable.

END OF SECTION

SECTION 26 05 73

OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes computer based modeling of electrical distribution systems to determine available fault currents, device short circuit ratings and overcurrent protective device settings for proper coordination.

1.03 DEFINITIONS

- A. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.
- B. NRTL: Nationally Recognized Testing Laboratory

1.04 QUALITY ASSURANCE

- A. Studies shall be performed using computer programs. Hand calculations and plots are not acceptable.
- B. Studies shall be performed under the supervision of a Professional Engineer.
- C. Field adjustments shall be performed by an independent agency. Agency shall be a member of the InterNational Electrical Testing Association or shall be a NRTL as defined by OSHA.

1.05 SUBMITTALS

- A. Computer modeling input data.
- B. Study results
- C. Overcurrent Protective Device plots, in color.
- D. Equipment evaluation report
- E. Summary of device ratings, setting ranges and final settings.
- F. Study signed by a Professional Engineer licensed in California.

PART 2 - PRODUCTS

2.01 ACCEPTABLE COMPUTER SOFTWARE MANUFACTURERS

- A. Subject to compliance with requirements, perform studies using the most recent version of software available from the following:
 - 1. ESA Inc.
 - 2. EDSA Power Analytics
 - 3. SKM Systems Analysis

2.02 OVERCURRENT PROTECTIVE DEVICE SHORT CIRCUIT AND COORDINATION STUDY

- A. Furnish System Short Circuit Studies based on the available fault current at the service equipment supplied by the Electric Utility (SDG&E) and calculated using the per unit method or in accordance with the latest Institute of Electrical and Electronics Engineers, Inc. (IEEE) recommendations. The study shall include the assumptions used in the calculation including motor contribution, conduit types, etc. Reports shall be submitted in copies bound with a stiff cover. The studies shall be submitted during the shop drawing submittal period. This study shall show that all equipment proposed is rated to exceed the maximum ultimate fault circuit level available.
- B. Furnish a Coordination (selectivity) Study of all adjustable protective devices. Study shall be presented on 11" x 17" LOG-LOG paper. Studies shall be submitted in copies bound with a stiff cover. Upon approval of the study, the Contractor shall set devices at the agreed-upon settings and provide a data sheet to the District's representative, with a copy to the District, indicating final setting for all adjustable devices. The coordination study shall be submitted before switchboard, panelboards, feeders, etc., are being installed on site.
- C. The studies shall be performed by a California licensed Professional Electrical Engineer employed by a qualified firm regularly engaged in preparing studies of this type.

PART 3 - EXECUTION

3.01 FIELD ADJUSTING

- A. Test and adjust overcurrent protective devices according to the recommended settings provided in the Coordination Study.

END OF SECTION

SECTION 26 09 23

LIGHTING CONTROL DEVICES

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. Time switches.
 - 2. Photoelectric switches.
 - 3. Daylight-harvesting controls.
 - 4. Indoor occupancy sensors.
 - 5. Outdoor motion sensors.
 - 6. Room Controllers.
 - 7. Lighting contactors.
 - 8. Emergency shunt relays.
 - 9. Modular dimming controls.
- B. Related Requirements:
 - 1. Section 26 27 26 "Wiring Devices" for manual toggle switches and occupancy-controlled receptacles.
 - 2. CalGreen.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show installation details for occupancy and light-level sensors.
 - 1. Interconnection diagrams showing field-installed wiring.
 - 2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of lighting control device to include in Operation and Maintenance manuals.

- B.** Acceptance Testing Certification: For each interior and exterior space as required by CCR Title 26 Part 6.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

- A.** Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Intermatic, Inc.
 2. NSi Industries LLC; TORK Products.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

- A.** Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper Industries, Inc.
 2. Intermatic, Inc.
 3. NSi Industries LLC; TORK Products.
 4. Tyco Electronics; ALR Brand.

2.3 DAYLIGHT-HARVESTING DIMMING CONTROLS

- A.** Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper Industries, Inc. "Greengate"
 2. Acuity Brands "nLight"
 3. WattStopper "DLM"
 4. Douglas Lighting Controls
 5. Or Approved Equal
- B.** System Description: Sensing daylight and electrical lighting levels, the system adjusts the indoor electrical lighting levels. As daylight increases, the lights are dimmed.
1. Lighting control set point is based on two lighting conditions:
 - a. When no daylight is present (target level).
 - b. When significant daylight is present.
 2. System programming is done with two hand-held, remote-control tools.
 - a. Initial setup tool.
 - b. Tool for occupants to adjust the target levels by increasing the set point up to 25 percent.
- C.** Ceiling-Mounted Dimming Controls: Solid-state, light-level sensor unit, with separate controller unit, to detect changes in lighting levels that are perceived by the eye.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Sensor Output: 0- to 10-V dc to operate electronic dimming ballasts and light engines. Sensor is powered by controller unit.
3. Power Pack: Sensor has 24-V dc, Class 2 power source, as defined by NFPA 70.
4. Light-Level Sensor Set-Point Adjustment Range: 20 to 60 fc.

2.4 INDOOR OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Cooper Industries, Inc. "Greengate"
 2. Acuity Brands "nLight"
 3. WattStopper "DLM"
 4. Douglas Lighting Controls
 5. Or Approved Equal
- B. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.
 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
 4. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 HP at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
 5. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 6. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
 7. Bypass Switch: Override the "on" function in case of sensor failure.
 8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; turn lights off when selected lighting level is present.
- C. PIR Type: Ceiling mounted; detect occupants in coverage area by their heat and movement.
 1. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in..
 2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.
 3. Detection Coverage (Corridor): Detect occupancy within 90 feet when mounted on a 10-foot- high ceiling.

- D. Ultrasonic Type: Ceiling mounted; detect occupants in coverage area through pattern changes of reflected ultrasonic energy.
 - 1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
 - 2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. when mounted on a 96-inch- high ceiling.
 - 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.
 - 4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. when mounted on a 96-inch- high ceiling.

- E. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet when mounted on a 10-foot- high ceiling in a corridor not wider than 14 feet. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using both PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by selecting controls on unit.
 - 1. Sensitivity Adjustment: Separate for each sensing technology.
 - 2. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
 - 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.

2.5 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Industries, Inc. "Greengate"
 - 2. Acuity Brands "nLight"
 - 3. WattStopper "DLM"
 - 4. Douglas Lighting Controls
 - 5. Or Approved Equal

- B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application, and shall comply with California Title 24.
 - 2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 degrees F.
 - 3. Switch Rating: Not less than 800-VA fluorescent at 120 V and 1200-VA fluorescent at 277 V.
 - 4. Switch Rating: Not less than 800-VA LED at 120 V and 1200-VA LED at 277 V.

- C. Wall-Switch Sensors:

1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 900 sq. ft. (84 sq. m).
2. Sensing Technology: PIR.
3. Switch Type: SP, manual "on," automatic "off."
4. Voltage: 120/277 V; passive-infrared type.
5. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc (108 to 1600 lux). The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
7. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space to help eliminate false "off" switching.

2.6 OUTDOOR MOTION SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Cooper Industries, Inc. "Greengate"
 2. Acuity Brands "nLight"
 3. WattStopper "DLM"
 4. Douglas Lighting Controls
 5. Or Approved Equal
- B. General Requirements for Sensors: Solid-state outdoor motion sensors.
 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application, and shall comply with California Title 24.
 2. PIR type, weatherproof. Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. Comply with UL 773A.
 3. Switch Rating:
 - a. Lighting-Fixture-Mounted Sensor: 500-VA fluorescent or to match controlled LED and driver.
 - b. Separately Mounted Sensor: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 HP at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
 4. Switch Type: SP, dual circuit. With bypass switch to override the "on" function in case of sensor failure.
 5. Voltage: 277-V type.
 6. Detector Coverage:
 - a. Standard Range: 210-degree field of view, with a minimum coverage area of 900 sq. ft.
 - b. Long Range: 180-degree field of view and 110-foot detection range.

7. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc (108 to 1600 lux). The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
8. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
9. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and help eliminate false "off" switching.
10. Operating Ambient Conditions: Suitable for operation in ambient temperatures ranging from minus 40 to plus 130 degrees F (minus 40 to plus 54 degrees C), rated as "raintight" according to UL 773A.

2.7 ROOM CONTROLLER

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Cooper Industries, Inc. "Greengate"
 2. Acuity Brands "nLight"
 3. WattStopper "DLM"
 4. Douglas Lighting Controls
 5. Or Approved Equal
- B. General Requirements for Room Controllers: Provides a control and communication interface between line voltage circuits and low voltage sensors.
 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application, and shall comply with California Title 24.
 2. Listed under UL 508 and UL 924.
 3. Operating Ambient Conditions: Dry interior conditions, 32 to 104 degrees F.
 4. Input Voltage Rating: 120/277 V-ac.
 5. Line Voltage Output Rating: Not less than 20A combined load per Room Controller. Relay contacts rated for 20A ballast load at 120/277-V ac, for 15A tungsten at 120-V ac, and for 1 HP at 120-V ac.
 6. Class 2 Dimming Output Rating: 0-10-V dc.
 7. Manual or automatic ON, BI-LEVEL, TRI-LEVEL and DIMMING control.
 8. Integral Demand Response unit.
 9. Integral skylight connection for classroom applications.
 10. UL 924 emergency relay in separate or barriered compartment.
 11. Integral receptacle (plug-load) control relay when required.
 12. Automatic functionality upon power-up.
 13. Compatible with LED dimming drivers.
- C. Control Wiring for Room Controllers: Class 2 using RJ45 or equivalent low-voltage bus between controller and low voltage sensors.

2.8 LIGHTING CONTACTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Allen-Bradley/Rockwell Automation.

2. ASCO Power Technologies, LP.
 3. Eaton Corporation.
 4. Square D.
- B. Description: Electrically operated and mechanically held, combination-type lighting contactors, complying with NEMA ICS 2 and UL 508.
1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current) and LED.
 2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
 3. Enclosure: Comply with NEMA 250.
 4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.
- C. BAS Interface: Provide hardware interface to enable the BAS to monitor and control lighting contactors.
1. Monitoring: On-off status.
 2. Control: On-off operation.

2.9 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 24 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
- B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 WIRING INSTALLATION

- A. Wiring Method: Comply with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.
- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes, terminal cabinets, or equipment enclosures.

3.3 IDENTIFICATION

- A. Identify components and power and control wiring according to Section 26 05 53 "Identification for Electrical Systems."
 - 1. Identify controlled circuits in lighting contactors.
 - 2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
- B. Permanently Label time switches and contactors with a unique designation.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate lighting control devices and perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
 - a. Include testing of modular dimming control equipment under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.
 - b. Remove and replace malfunctioning modular dimming control components and retest as specified above.
 - 2. Perform and document all acceptance tests required by California Title 24 Energy Code. Coordinate acceptance testing with commissioning agent when commissioning is applicable. Testing shall include, but not necessarily limited, to the following:
 - a. Automatic Daylighting Control Acceptance.
 - b. Occupant Sensor Acceptance.
 - c. Automatic Time Switch Control Acceptance.

- d. Demand Response Controls.
 - e. Outdoor Motion Sensor Acceptance.
 - f. Outdoor Lighting Shut Off Controls.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment at no additional cost to the District.
- D. Lighting control devices will be considered defective if they do not pass tests and inspections.
- E. Reports: Provide written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments. Reports shall be completed and signed by the certified technician and submitted to the District and to other entities as required by CCR Title 24 Part 6.

3.5 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
 - 1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit District's operations.
 - 2. For daylighting controls, adjust set points and dead band controls to suit District's operations.
 - 3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train District's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION

SECTION 26 22 00

LOW VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA.

- 1. Dry-type distribution transformers

1.03 DEFINITIONS

- A. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.
- B. CalGreen: California Green Building Standards, CCR Title 24, Part 11, Chapter 5.
- C. NRTL: Nationally Recognized Testing Laboratory.

1.04 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member of NETA or an NRTL.

1.05 SUBMITTALS

- A. Product Data
 - 1. Material List: A material list with names of manufacturers, model numbers, and technical information on all equipment proposed.
 - 2. Product technical information sheets for each principal component in the proposed system. Identify by arrow, circle or similar means products being proposed. Submittals consisting of unmodified catalog pages with no markings will be rejected.
 - 3. Weight, dimensions and shipping splits.
 - 4. Equipment operating and service (maintenance) clearances required around the equipment.
- B. Shop Drawings
- C. Test Procedures: A written document detailing the proposed test procedures of the system shall be supplied. These procedures shall include all tests required by the equipment manufacturer and by this specification.
- D. Test Results Report: The results of the execution of the testing procedure, including the items tested or inspected, the date, and by whom.

- E. Operation and Maintenance (O&M) Manuals: Furnish composite "Systems Operation and Maintenance" manuals in indexed three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain, but not be limited to:
1. Test procedures and test results.
 2. Instruction for the proper operation and maintenance of the system.
 3. Factory issued technical, installation, and maintenance manuals.
 4. Factory issued operation manuals.
 5. A replacement parts list complete with part numbers and name, address, and phone number of suppliers used by the Contractor. A spare parts list recommended for purchase by the District shall be included.
 6. All portions of the material list and shop drawings which are not included in the foregoing.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 2. Siemens Energy & Automation, Inc.
 3. Square D; a brand of Schneider Electric.
- B. Source Limitations: Obtain materials and accessories from single source from single manufacturer.

2.02 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.
- B. Comply with CEC.

2.03 TRANSFORMERS INDIVIDUALLY MOUNTED

- A. Dry, ventilated, self-cooled type with finish paint over a bonderized or equal rust inhibiting treatment and suitable for mounting methods indicated on drawings. 220°C. (Class H) insulation system with rated temperature rise of 150°C above a 40°C ambient and rated K-4 or higher. NEMA standard taps except not less than four full capacity 2 1/2% taps with two above and two below normal. Provide neutral busbar sized for at least 200% of the ampacity of the secondary phase conductors. Where mounted outdoors, transformers shall have rain tight enclosures.
- B. Impedance shall be manufacturer's standard.

- C. Transformers shall have front, bottom and/or side cooling
- D. Assume responsibility for the proposed transformer unit fitting in the allocated space with required clearances, working space and access. Where mounted directly to wall, no ventilation louvers shall be located on the wall side of the transformer. Mounting bolts shall be adequate in size and properly secured to base, wall, or metal framework in conformance to Seismic Restraints subsection and shall not have metal to metal contact between the transformer unit and its supports. Provide flexible conduits for all conduits connected to transformers and with sufficient slack that they are easily movable by hand when installed.
- E. Where transformer is floor mounted, provide a base per Concrete Equipment Bases subsection.
- F. Provide a nameplate engraved "TRANSF. X" (designation as indicated on drawings with 1/4" high letters), origin of primary feeder (such as "FED FROM SWBD MSB"), and secondary service (such as "SERVES DIST. PNL DP").

PART 3 - EXECUTION

3.01 INSTALLATION OF POWER DISTRIBUTION EQUIPMENT

- A. Installation shall conform to the requirements of the CEC and to the manufacturer's shop drawings and mounting instructions. Equipment base for floor standing equipment shall have an adequate number of anchor bolt holes to put the base in direct contact shear and tension with the mounting surface at all anchor bolt locations. Refer to Section 26 05 48 "VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS".
- B. Loosen or remove shipping bolts per manufacturer's installation instructions to allow proper function of factory vibration isolation system.

3.02 FIELD QUALITY CONTROL

- A. Equipment installed under this section shall be inspected for defects, and tested for proper operation.
- B. Enclosures shall be checked for cleanliness inside and out and for defective or damaged finish.
- C. Systems shall be tested for short circuits, open circuits and wrong connections and shall be free from mechanical and electrical defects.
- D. Bolted connections shall be torque tightened to manufacturer's specifications.
- E. Adjust taps as necessary for proper secondary voltage.
- F. Where required or directed, systems shall be tested in the presence of the Owner's representative to demonstrate that equipment furnished, installed or connected functions in the manner intended.
- G. The Contractor shall furnish all necessary instruments and equipment and all power sources and connections required for making required tests, and shall immediately correct any defective work at no additional charge.

END OF SECTION

SECTION 26 24 13

SWITCHBOARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Switchboards
 - 2. Circuit Breakers

1.03 DEFINITIONS

- A. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.
- B. NRTL: Nationally Recognized Testing Laboratory.
- C. SCCR: Short-circuit Current Rating.
- D. TCC: Time-Current Curve(s).

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.
- B. Testing Agency Qualifications: Member of NETA or an NRTL.
- C. Equipment shall be UL listed and labeled.
- D. Comply with NEMA PB 2.
- E. Comply with CEC.
- F. Comply with UL 891.

1.05 SUBMITTALS

- A. Product Data
 - 1. Material List: A material list with names of manufacturers, model numbers, and technical information on all equipment proposed.
 - 2. Product technical information sheets for each principal component in the proposed system. Identify by arrow, circle or similar means products being proposed. Submittals consisting of unmodified catalog pages with no markings will be rejected.
 - 3. Weight, dimensions and shipping splits.

4. Equipment operating and service (maintenance) clearances required around the equipment.
- B. Shop Drawings
- C. Test Procedures: A written document detailing the proposed test procedures of the system shall be supplied. These procedures shall include all tests required by the equipment manufacturer and by this specification.
- D. Test Results Report: The results of the execution of the testing procedure, including the items tested or inspected, the date, and by whom.
- E. Operating Sequences: Provide a complete written description of the Sequence of Operation of each of the systems including startup and recovery procedures
- F. Samples: when requested by Architect
- G. Operation and Maintenance (O&M) Manuals: Furnish composite "Systems Operation and Maintenance" manuals in indexed three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain, but not be limited to:
 1. Operational procedures for the overall systems including the "Sequence of Operation".
 2. Test procedures and test results.
 3. Instruction for the proper operation and maintenance of the system.
 4. Factory issued technical, installation, and maintenance manuals.
 5. Factory issued operations and programming (software) manuals.
 6. A replacement parts list complete with part numbers and name, address, and phone number of suppliers used by the Contractor. A spare parts list recommended for purchase by the District shall be included.
 7. All portions of the material list and shop drawings which are not included in the foregoing.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 2. Siemens Energy & Automation, Inc.
 3. Square D; a brand of Schneider Electric.
- B. Source Limitations: Obtain materials and accessories from single source from single manufacturer.

2.02 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.
- B. Comply with CEC.

2.03 SHORT CIRCUIT (FAULT CURRENT DUTY) AND SELECTIVITY REQUIREMENTS

- A. The available short circuit current values indicated for the distribution system may be accommodated in the following ways. If the available short circuit current is not indicated for a specific distribution system component, use the nearest upstream value indicated. Bus bar bracing shall be adequate for the values indicated.
 - 1. Adequate interrupting ratings for all circuit breakers in the equipment.

2.04 SOLID STATE TRIP SETTINGS

- A. The circuit breaker manufacturer shall provide a table showing the electronic trip unit settings which will result in a trip curves similar to the trip curve of a thermal-magnetic circuit breaker of the same ampere rating.
 - 1. The table shall list each of the breaker types and frame ampere sizes to be supplied for the project.
 - 2. Thermal-magnetic circuit breakers do not have short-time tripping characteristics. To approximate the characteristics of a thermal-magnetic circuit breaker, the short-time pickup level should be equal to the instantaneous pickup level. The short-time and instantaneous pickup levels in the table shall be presented in ranges that approximate the "Lo" to "Hi" magnetic adjustment ranges supplied on thermal-magnetic circuit breakers.
- B. Trip settings shall be done by a competent person designated by the Contractor. Furnish a tabulation of all SST breakers with their final solid state trip settings.

2.05 SWITCHBOARDS

- A. Provide switchboards in accordance with diagram and details on the drawings. Breakers shall be 600 volt pad lockable type. Anchor the switchboard to the base with a minimum of two pair (back and front) ½ inch anchor bolts (not drilled or after set) spaced maximum 5 feet apart per pair. Refer to CONCRETE EQUIPMENT BASES and SEISMIC RESTRAINTS Subsections.
- B. Switchboards shall be metal enclosed, free standing type with sections joined together to form one assembly. Structures shall consist of steel angle frame not less than 12 gauge fabricated steel formed into standardized units. Each structure shall be designed so that breaker units may be interchanged. Structure shall have manufacturer's standard gray finish. Provide full capacity bus full height of switchboard with filler panels for unused portion of board. Ties between sections shall be bussed. Busbars shall be braced for the available short circuit current indicated. Provide horizontal and vertical wiring space within each structure.
- C. Provide a copper equipment ground bus, minimum size 1/4" x 2" cross section.
- D. Provide a nameplate for each switchboard indicating its designation (such as "SWITCHBOARD MSB" in 1/4" high letters), as indicated on drawings, the voltage

system (such as "208/120V-3PH-4W"), and origin of feeder (such as "FED FROM SWBD MS"). Provide nameplates for each feeder circuit breaker unit indicating the use or load served (such as "MAIN" or "PANEL A").

- E. The metering provisions shall comply with requirements of the serving Utility Company. Shop drawings shall be approved by the Utility Company prior to fabrication.
- F. The bonding jumper for service rated switchboards shall be located on the line side of the neutral disconnect link.

2.06 CIRCUIT BREAKERS

- A. General: Breakers 250 ampere frame and larger shall be solid state trip (SST) type unless other special types are indicated on drawings. Breakers with smaller than 250 ampere frames may be thermal magnetic trip (TM) or SST type unless otherwise indicated on drawings. Mounting height of breaker operating handles shall not exceed 6½' above floor (consider housekeeping (cleaning) pad for floor mounted switchboards when determining the measurement).
- B. Solid state trip breakers (SST) shall be insulated case or molded case type, ratings and types as indicated, equipped with self-powered ambient insensitive solid-state trips, with current sensors and solid-state logic circuits integral to the circuit breaker frame. The solid-state current control shall provide long-delay pickup, long-delay time, short-delay pickup, short-delay time, instantaneous pickup (or selectable override per manufacturer's recommendations) adjustments. Settings shall be sealable to prevent tampering. For programmable breakers, provide two portable battery power supply units which will permit the breaker settings to be programmed when the breaker is not energized.
- C. Thermal magnetic breakers rated 150 ampere frame through 225 ampere frame shall have interchangeable (replaceable) trip elements and adjustable instantaneous trip.
- D. Certain circuit breakers such as 100% rated breakers may require the use of 90°C insulated wire (sized at the 75°C ampacity). If it is required it will be marked as such by the manufacturer.
- E. Light duty commercial/residential type thermal magnetic breakers. Use only in Panels (not in Power Panels). Cutler-Hammer bolt-on type, Quicklag or equal.
- F. Where "Bussed Space" or "Space" is indicated on a one-line diagram or in a panel schedule it means "provisions" including a busbar kit for the breaker frame size indicated.

PART 3 - EXECUTION

3.01 INSTALLATION OF POWER DISTRIBUTION EQUIPMENT

- A. Installation shall conform to the requirements of the CEC and to the manufacturer's shop drawings and mounting instructions. Equipment base for floor standing equipment shall have an adequate number of anchor bolt holes to put the base in direct contact shear and tension with the mounting surface at all anchor bolt locations. Refer to Section 26 05 48 "VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS".
- B. Provide engraved nameplates for the switchboard and each feeder device.

3.02 WORK IN EXISTING SWITCHBOARDS

- A. Existing switchboards shall be modified as indicated on the drawings. The specifications for new switchboards shall apply to work in existing except as otherwise indicated.
- B. New components such as circuit breakers, switches, relays, and contactors shall either be of the same manufacturer and type as existing in the board or shall comply with paragraphs where those items are specified.
- C. New bolted connections shall be torque tightened as recommended by the manufacturer of the equipment.
- D. Provide or replace nameplates, tags or labels as required. Install new circuit directories in all panels where changes are made or where directories are not correct. Provide new plastic cover if existing is missing.
- E. Finish new faceplates and components shall match existing as closely as possible.
- F. Where new panel interiors or components are provided, submit shop drawings as required under "SUBMITTALS."

3.03 FIELD QUALITY CONTROL

- A. Equipment installed under this section shall be inspected for defects, and tested for proper operation.
- B. Enclosures and cabinets shall be checked for cleanliness inside and out and for defective or damaged finish.
- C. Systems shall be tested for short circuits, open circuits and wrong connections and shall be free from mechanical and electrical defects.
- D. Bolted connections shall be torque tightened to manufacturer's specifications.
- E. Where required or directed, systems shall be tested in the presence of the District's representative to demonstrate that equipment furnished, installed or connected functions in the manner intended.
- F. The Contractor shall furnish all necessary instruments and equipment and all power sources and connections required for making required tests, and shall immediately correct any defective work at no additional charge.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Distribution Panelboards
 - 2. Lighting and Appliance Panelboards
 - 3. Panelboard Circuit Breakers
 - 4. Fusible Switches

1.03 DEFINITIONS

- A. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.

1.04 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
- B. Equipment shall be UL listed and labeled.
- C. Comply with NEMA PB 1.
- D. Comply with CEC.

1.05 SUBMITTALS

- A. Product Data
 - 1. Material List: A material list with names of manufacturers, model numbers, and technical information on all equipment proposed.
 - 2. Product technical information sheets for each principal component in the proposed system. Identify by arrow, circle or similar means products being proposed. Submittals consisting of unmodified catalog pages with no markings will be rejected.
 - 3. Weight, dimensions and shipping splits.
 - 4. Equipment operating and service (maintenance) clearances required around the equipment.

- B. Shop Drawings: Shop drawings for all equipment specified in this section shall be submitted for review and approval in accordance with Section 26 00 00, General Electrical Requirements.
- C. Test Procedures: A written document detailing the proposed test procedures of the system shall be supplied. These procedures shall include all tests required by the equipment manufacturer and by this specification.
- D. Test Results Report: The results of the execution of the testing procedure, including the items tested or inspected, the date, and by whom.
- E. Operating Sequences: Provide a complete written description of the Sequence of Operation of each of the systems including startup and recovery procedures.
- F. Samples: when requested by Architect.
- G. Operation and Maintenance (O&M) Manuals: Furnish composite "Systems Operation and Maintenance" manuals in indexed three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain, but not be limited to:
 - 1. Operational procedures for the overall systems including the "Sequence of Operation".
 - 2. Test procedures and test results.
 - 3. Instruction for the proper operation and maintenance of the system.
 - 4. Factory issued technical, installation, and maintenance manuals.
 - 5. A replacement parts list complete with part numbers and name, address, and phone number of suppliers used by the Contractor. A spare parts list recommended for purchase by the District shall be included.
 - 6. All portions of the material list and shop drawings which are not included in the foregoing.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. Siemens Energy & Automation, Inc.
 - 3. Square D; a brand of Schneider Electric.
- B. Source Limitations: Obtain materials and accessories from single source from single manufacturer.

2.02 DISTRIBUTION PANELBOARDS

- A. Panelboards shall be metal enclosed, dead front type with sections joined together to form one assembly. Assembly shall consist of group mounted devices arranged so that they may be removed or interchanged from the front of the panel without disturbing the adjacent devices. Provide full capacity bus full height of panel with filler panels for unused portion of panel. Ties between sections shall be bussed. Busbars shall be braced for the available short circuit current indicated.
- B. Busbars shall be copper for bus ratings 600 amperes or less, aluminum for ratings greater than 600 amperes. Neutral busbar material shall match phase busbars. Provide copper equipment ground bus. When indicated on drawings, provide panel with neutral busbar sized for at least [100%] [200%] of phase busbars.
- C. Provide a nameplate for each panel indicating its designation (such as "DISTRIBUTION PANEL DP-1" in 1/4" high letters) as indicated on drawings, the voltage system (such as "208/120V-3PH-4W"), and origin of feeder (such as "FED FROM SWBD MSB"). Provide a nameplate for each circuit breaker unit indicating the load served (such as "PANEL A").

2.03 BRANCH CIRCUIT PANELBOARDS

- A. Panelboards for lighting and miscellaneous power shall be the dead front safety type equipped with bolt-on circuit breakers of the numbers and sizes shown on the drawing and herein. Multiple pole breakers shall have an internal common trip. Tie handles will not be permitted. Breakers serving multiwire branch circuits shall be multiple pole breakers per CEC, even if indicated as single pole on the drawings. Breakers shall have a SWD listing. Provide GFCI type breakers as indicated on drawings and when required by CEC.
- B. Busbars shall be copper, braced for the available short circuit current, and have the capacities required on the plans but not less than the ampere frame size of the protective device supplying the panelboard. Neutral busbar material shall match phase busbars. All panelboards shall be equipped with a copper equipment ground bus. When indicated in panel schedule, provide an oversized neutral comprised of split neutral busbars and each half shall have the same ampere rating as the phase busbars and be equipped with double lugs.
- C. Termination lugs shall be rated for 75°C.
- D. Each branch circuit shall have a permanently fixed number. Provide a typewritten directory mounted in a metal frame with clear plastic cover, on the inside of the cabinet door giving the circuit number and a complete description of all outlets controlled by each panel circuit breaker. Consult Owner's representative for correct room and/or furniture system module designation scheme (not necessarily those shown on drawings). Mark "spares" with pencil only and leave "spaces" blank.

- E. Provide a nameplate for each panelboard indicating the panel designation (such as "PANEL 3A") as indicated on drawings, the voltage system (such as 208Y/120V-3PH-4W"), and origin of feeder (such as "FED FROM SWBD MSA").
- F. Doors shall be fastened to trim with concealed hinges and provided with flush type combination catch and lock. All locks shall be keyed alike and shall match the District's standard key. Mount floor standing panelboards on a base. Refer to Concrete Equipment Bases subsection. Where panelboards are shown mounted free standing, provide an angle iron or strut channel rack suitably braced to support these panels.
- G. Where panelboards are installed flush in walls, extend empty conduits from panel to an accessible space above or as indicated on plans. Provide a minimum of one 3/4" conduit for each three single pole spare circuit breakers or spaces, or equivalent, but not less than three conduits.
- H. 208Y/120V panelboard boxes shall have blank end plates (top and bottom). Concentric knockouts are not acceptable.
- I. Refer to Paint, Finishes and Colors subsection.
- J. Special panelboard construction or features shall be as shown on drawings. For circuit breakers, switches, contactors and other equipment to be included as an assembled part of the panelboard, refer to the paragraph where those items are specified. Panels for exterior use shall have weatherproof enclosures.

K. CIRCUIT BREAKERS

- L. General: Breakers 150 ampere frame through 225 ampere frame shall have interchangeable (replaceable) trip elements and adjustable instantaneous trip. Breakers 250 ampere frame and larger shall be solid state trip (SST) type unless other special types are indicated on drawings. Breakers with smaller than 250 ampere frames may be thermal magnetic trip (TM) or SST type unless otherwise indicated on drawings. Mounting height of breaker operating handles shall not exceed 6½' above floor (consider housekeeping (cleaning) pad for floor mounted switchboards when determining the measurement).
- M. Solid state trip breakers (SST) shall be insulated case or molded case type, ratings and types as indicated, equipped with self powered ambient insensitive solid-state trips, with current sensors and solid-state logic circuits integral to the circuit breaker frame. The solid-state current control shall provide long-delay pickup, long-delay time, short-delay pickup, short-delay time, instantaneous pickup (or selectable override per manufacturer's recommendations) adjustments. Settings shall be sealable to prevent tampering. Provide two portable battery power supply units which will permit the breaker settings to be programmed when the breaker is not energized.

- N. Light duty commercial/residential type thermal magnetic breakers. Use only in Panels (not in Power Panels).
- O. Where "Bussed Space" or "Space" is indicated on a one-line diagram or in a panel schedule provide complete "provisions" including a busbar kit for the breaker frame size indicated.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Installation shall conform to the requirements of the CEC and to the manufacturer's shop drawings and mounting instructions. Equipment base for floor standing equipment shall have an adequate number of anchor bolt holes to put the base in direct contact shear and tension with the mounting surface at all anchor bolt locations. Refer to Section 26 05 48 "VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS" for seismic restraints requirements.
- B. Provide an identification nameplate as specified under 26 05 53 "IDENTIFICATION FOR ELECTRICAL SYSTEMS." Each circuit breaker pole shall be identified with a number designation. Circuits shall be arranged as shown on the schedules.

3.02 EXISTING PANELBOARDS

- A. Existing panelboards shall be modified as indicated on the drawings. The specifications for new switchboards and panelboards shall apply to work in existing except as otherwise indicated.
- B. New components such as circuit breakers, switches, relays, and contactors shall either be of the same manufacturer and type as existing in the board or shall comply with paragraphs where those items are specified.
- C. New bolted connections shall be torque tightened as recommended by the manufacturer of the equipment.
- D. Provide or replace nameplates, tags or labels as required.
- E. Finish on new faceplates and components shall match existing as closely as possible.
- F. Where new panel interiors or components are provided, submit shop drawings as required under "SUBMITTALS."
- G. For all existing panelboards to be modified, provide a typewritten directory mounted in a plastic frame on the inside of the cabinet door giving the circuit number and a complete description of all circuits controlled by each circuit breaker. Consult Owner's representative for correct room and/or furniture system module designation scheme (not necessarily those shown on drawings).

3.03 CHECKING AND TESTING OF EQUIPMENT

- A. Equipment installed under this section shall be inspected for defects, and tested for proper operation.
- B. Enclosures and cabinets shall be checked for cleanliness inside and out and for defective or damaged finish.
- C. Systems shall be tested for short circuits, open circuits and wrong connections and shall be free from mechanical and electrical defects.
- D. Bolted connections shall be torque tightened to manufacturer's specifications.
- E. Where required or directed, systems shall be tested in the presence of the Owner's representative to demonstrate that equipment furnished, installed or connected functions in the manner intended.
- F. Contractor shall furnish all necessary instruments and equipment and all power sources and connections required for making required tests, and shall immediately correct any defective work at no additional charge.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes:
 - 1. Snap switches
 - 2. Keyed switches
 - 3. Duplex receptacles
 - 4. GFCI receptacles
 - 5. Special purpose receptacles
 - 6. Device plates

1.03 DEFINITIONS

- A. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.
- B. CBC: California Building Code (CCR Title 24, Part 2)
- C. GFCI: Ground-fault Circuit Interrupter
- D. NECA 1: Standard Practice of Good Workmanship in Electrical Contracting
- E. SPD: Surge Protective Device, formerly TVSS: Transient Voltage Surge Suppressor

1.04 QUALITY ASSURANCE

- A. Comply with CEC and NECA 1.

1.05 SUBMITTALS

- A. Product Data
 - 1. Material List: A material list with names of manufacturers, model numbers, and technical information on all equipment proposed.
 - 2. Product technical information sheets for each principal component in the proposed system. Identify by arrow, circle or similar means products being proposed. Submittals consisting of unmodified catalog pages with no markings will be rejected.
- B. Shop Drawings
- C. Samples: when requested by Architect

- D. Operation and Maintenance (O&M) Manuals: Furnish composite "Systems Operation and Maintenance" manuals in indexed three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain, but not be limited to:
1. Instruction for proper operation.
 2. Factory issued technical, installation, and maintenance manuals.
 3. Factory issued operations and programming (software) manuals.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.

2.02 ACCEPTABLE MANUFACTURERS

- A. Source Limitations: Obtain materials and accessories from single source from single manufacturer.

2.03 SWITCHES

- A. AC general use snap switches shall be industrial grade toggle handle, quiet operating, UL 20 listed and verified to meet Federal Specification W S 896 and NEMA WD 1 heavy duty tests.
- B. Switches shall be rated 120/277V, 20A.
- C. Toggle handle color shall be white.
- D. Switches shall be constructed with oversized silver cadmium alloy contacts, permanent lubrication, and binding head screws suitable for #10 AWG wire, back & side wire. Connection shall be made by wrapping the wire around the screw or tightening a screw clamp. Push in type connections are not acceptable. Switches may have built in pigtail connection in lieu of screw connection. Switches shall be self- grounding.
- E. Acceptable Manufacturers:
1. Cooper (Arrow Hart) 1221
 2. Hubbell HBL1221
 3. Leviton 1221-2
 4. Pass & Seymour #PS20AC1
- F. Keyed and momentary contact switches, required but not listed, shall be of the same manufacturers and identical quality as those listed above.
- G. Illuminated mushroom pushbuttons for shop power shutdown shall be 2¼" diameter, red, equal to Square D 9001 series, mounted on stainless steel plate. Plate shall be fastened with four screws, one at each corner.

2.04 RECEPTACLES

- A. General receptacle outlets shall be premium industrial grade 20A, 125 volt, 2 pole, 3 wire NEMA 5-20R. The attachment screw shall have an automatic grounding clip. A green grounding screw shall be mounted on the bridge which shall run around the back of a break and impact resistant plastic body. The bridge shall be securely locked to the body. Outlets shall be UL 498 listed and verified to meet Federal Specification WC 596 and NEMA WD 1 heavy duty performance tests. Contacts shall be extra heavy duty copper alloy or bronze double wipe type. Outlets shall have binding head screws suitable for #10 AWG wire. Connection shall be made by wrapping the wire around the screw or tightening a clamp. Push in type connections are not acceptable. Outlets may have built in pigtail connection in lieu of screw connection.
- B. Receptacle outlet faces shall be white. Exception: receptacles that are controlled by occupancy sensors as switched plug loads shall be gray.
 - 1. Acceptable Manufacturers:
 - a. Cooper (Arrow Hart) AH5362
 - b. Hubbell HBL5362
 - c. Leviton 5362
 - d. Pass & Seymour 5362
- C. Receptacles installed outdoors or in other damp or wet locations shall be listed weather-resistant.
- D. Ground fault circuit interrupter (GFCI) outlets shall be specification grade UL 498 NEMA 5-20R 125V 20A duplex grounding non-feed-through type self-testing receptacle, designed to prevent normal operation when miswired, suitable for mounting in a standard outlet box. A ground current of 5 milliamps or higher shall trip the circuit open in less than 1/30 second. There shall be a test button and a reset button on the front. Each GFCI outlet shall be tested after installation and results of the test submitted in writing.
 - 1. Acceptable Manufacturers:
 - a. Cooper (Arrow Hart)
 - b. Hubbell GF20ST
 - c. Leviton S7899
 - d. Pass & Seymour 2094
- E. Industrial type outlets shall be by Crouse Hinds, Appleton, or Russell and Stoll, and shall be rated for the amps, volts, poles, and wires indicated on the drawings.

- F. Special power outlets, not listed above, shall be standard NEMA configuration as noted on drawings and shall be of at least equal grade and quality to those listed above. Special receptacles not available in color may be silver or black finish.

2.05 DEVICE PLATES

- A. Plates for flush wiring devices, including telephone outlets, shall be satin finish type 304 stainless steel. Wiring devices and device plates shall be the same manufacturer.
- B. Provide switch and device plates with engraved designations wherever called for by words, set off in quotation marks near a switch location, or by symbol. If inscription is not detailed on drawings request it from the Owner's representative. Engraving shall be in 1/8" high block type letters filled with black enamel.
- C. Finish plates for all surface mounted devices shall be pressed steel galvanized. Cover plates for flush mounted junction boxes in finished areas shall be selected by Owner's representative.
- D. For surface interior outlet and junction boxes of the pressed steel knockout type, use 1/2" raised galvanized steel plates for devices and flat galvanized steel for blank plates.
- E. Weatherproof faceplates shall consist of a hinged outlet cover/enclosure clearly marked "Suitable for Wet Locations While in Use" and "UL Listed". A gasket shall be provided between the enclosure and the mounting surface, and between the hinged cover and mounting plate/base.

PART 3 - EXECUTION

3.01 INSTALLATION OF OUTLETS AND EQUIPMENT

- A. All outlets, wall switches and wiring devices may be relocated within a radius of 12 feet at no additional charge to the Owner if such request is made prior to installation of the rough-in for the item.
- B. Accurately place outlet boxes independently and securely fasten to the structure and, in concealed work, provide with plaster rings and set flush with finished surface of walls or ceilings.
- C. Coordinate the location and mounting heights of wall-mounted receptacles, fire alarm and signal devices switches with casework, shelving, furniture, and other equipment shown on Architectural and Interiors drawings and fabrication shop drawings and comply with the Americans with Disabilities Act (ADA), CBC, ANSI, and all other applicable codes governing the project. Conflicts shall immediately be brought to the attention of the District's representative for resolution before the installation of the rough-in for the devices.
- D. Outlet and junction boxes for interior use shall be galvanized, one piece pressed or welded steel, knockout type, except where other types of boxes are indicated or specified. In masonry or concrete construction waterproof boxes manufactured for that purpose shall be used. Plastic, fiber or composition boxes will not be permitted.
- E. Protectively cover all devices, outlet boxes, cabinets, etc., before plastering and painting.
- F. All receptacles for restrooms, toilet rooms, custodial closets, locker rooms, kitchens, electric water coolers, vending machines and on building exterior shall be GFCI type.

3.02 FACEPLATE INSTALLATION

- A. Provide a plate for each outlet, receptacle, switch, device and box.
- B. Each switch, receptacle device, etc. which is installed in an outlet box with coverplate shall have the panel and circuit number engraved with 1/8" high black filled lettering at top of coverplate.
- C. Plates for outdoor locations shall be weatherproof .
- D. Ganged devices shall have gang plates exactly matching the arrangement and quantity of devices. All plates shall fit the box perfectly with no field modification necessary. Plates on surface mounted boxes shall not overhang the box. All plates shall be manufactured specifically for the type of outlet, device and box to which they are applied.

3.03 FIELD QUALITY CONTROL

- A. GFCI receptacles and GFCI branch circuit breakers shall be tested by applying a ground current of 5 mA, + 1 mA, which shall trip the unit off. Each test shall be recorded and the record shall include the type of test equipment used, results of test, location of device tested, date of test, and name of test technician. "Test" button operation shall be successfully demonstrated but will not be acceptable as a substitute for the trip test described.
- B. Where required or directed, systems shall be tested in the presence of the District's representative to demonstrate that equipment furnished, installed or connected functions in the manner intended.
- C. Contractor shall furnish all necessary instruments and equipment and all power sources and connections required for making required tests, and shall immediately correct any defective work at no additional charge.

END OF SECTION

SECTION 26 28 13

FUSES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes:
 - 1. Cartridge fuses rated 600V AC and less.
 - 2. Spare fuse cabinet

1.03 DEFINITIONS

- A. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.

1.04 QUALITY ASSURANCE

- A. Comply with NEMA FU 1.
- B. Comply with CEC.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.

1.05 SUBMITTALS

- A. Product Data
 - 1. Material List: A material list with names of manufacturers, model numbers, and technical information on all equipment proposed.
 - 2. Product technical information sheets for each principal component in the proposed system. Identify by arrow, circle or similar means products being proposed. Submittals consisting of unmodified catalog pages with no markings will be rejected.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Bussmann
 - 2. Littelfuse
 - 3. Mersen/Ferraz

- B. Source Limitations: Obtain materials and accessories from single source from single manufacturer.

2.02 FUSES

- A. Fuses for feeders and motor branch circuits shall be time delay current limiting type with 200,000 AIC. The time delay shall be minimum 10 sec. at 500% load for 600A or smaller fuses and 4 sec. at 500% load for larger than 600A. 600A. and smaller fuses shall be class RK1 or RK5. Fuses larger than 600A. shall be class 'L'.
- B. Upon District's acceptance of the electrical distribution system, provide the District's representative with spare fuses and cabinet to hold same as follows: Three fuses of each rating installed 601 amperes and larger, 10% of each type and rating installed 0 to 600 amperes, but not less than three of each.
- C. Fuse sizes shown on drawings protecting HVAC equipment are for reference only based on specified mechanical/plumbing equipment. Final determination of fuse sizes shall be made by Contractor based on CEC and approved mechanical/plumbing equipment nameplate ratings.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Fuses shall be installed so that the rating can be clearly read from the front of the open switch without removing the fuse.

END OF SECTION

SECTION 26 28 16

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes:
 - 1. Fusible switches
 - 2. Nonfusible switches

1.03 DEFINITIONS

- A. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.

1.04 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
- B. Equipment shall be UL listed and labeled.
- C. Comply with CEC.

1.05 SUBMITTALS

- A. Product Data
 - 1. Material List: A material list with names of manufacturers, model numbers, and technical information on all equipment proposed.
 - 2. Product technical information sheets for each principal component in the proposed system. Identify by arrow, circle or similar means products being proposed. Submittals consisting of unmodified catalog pages with no markings will be rejected.
 - 3. Weight, dimensions and shipping splits.
 - 4. Equipment operating and service (maintenance) clearances required around the equipment.
- B. Shop Drawings
- C. Test Procedures: A written document detailing the proposed test procedures of the system shall be supplied. These procedures shall include all tests required by the equipment manufacturer and by this specification.
- D. Test Results Report: The results of the execution of the testing procedure, including the items tested or inspected, the date, and by whom.

- E. Operating Sequences: Provide a complete written description of the Sequence of Operation of each of the systems including startup and recovery procedures
- F. Samples: when requested by Architect
- G. Operation and Maintenance (O&M) Manuals: Furnish composite "Systems Operation and Maintenance" manuals in indexed three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain, but not be limited to:
 - 1. Operational procedures for the overall systems including the "Sequence of Operation".
 - 2. Test procedures and test results.
 - 3. Instruction for the proper operation and maintenance of the system.
 - 4. Factory issued technical, installation, and maintenance manuals.
 - 5. Factory issued operations and programming (software) manuals.
 - 6. A replacement parts list complete with part numbers and name, address, and phone number of suppliers used by the Contractor. A spare parts list recommended for purchase by the District shall be included.
 - 7. All portions of the material list and shop drawings which are not included in the foregoing.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cutler-Hammer
 - 2. Siemens
 - 3. Square D
- B. Source Limitations: Obtain materials and accessories from single source from single manufacturer.

2.02 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.

2.03 SAFETY SWITCHES

- A. Externally operated switches shall be quick make, quick break, with interlocking cover. Switches and enclosures shall be heavy duty type. Provide Class R rejection clips if used with fuses. Switches used in indoor dry conditions shall have NEMA 1 enclosures. Switches exposed to wet or outdoor conditions shall have NEMA 3R enclosures.
- B. In case of a substitution of equipment served, the disconnect, fuses, circuit conductors, conduit, and circuit breaker shall be resized accordingly, at no additional cost.

- C. Toggle type, padlockable, manual motor starters without overload protection may be used, within their ratings, in lieu of safety switches for motor disconnects for air handling/air conditioning equipment when HVAC units are located above an accessible ceiling.

2.04 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. Siemens Energy & Automation, Inc.
 - 3. Square D; a brand of Schneider Electric.
- B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Breakers 150 ampere frame through 225 ampere frame shall have interchangeable (replaceable) trip elements and adjustable instantaneous trip. Breakers 250 ampere frame and larger shall be solid state trip (SST) type unless other special types are indicated on drawings. Breakers with smaller than 250 ampere frames may be thermal magnetic trip (TM) or SST type unless otherwise indicated on drawings. Mounting height of breaker operating handles shall not exceed 6½' above floor (consider housekeeping (cleaning) pad for floor mounted switchboards when determining the measurement).
- D. Solid state trip breakers (SST) shall be insulated case or molded case type, ratings and types as indicated, equipped with self-powered ambient insensitive solid-state trips, with current sensors and solid-state logic circuits integral to the circuit breaker frame. The solid-state current control shall provide long-delay pickup, long-delay time, short-delay pickup, short-delay time, instantaneous pickup (or selectable override per manufacturer's recommendations) adjustments. Settings shall be sealable to prevent tampering. Provide two portable battery power supply units which will permit the breaker settings to be programmed when the breaker is not energized.
- E. Features and Accessories:
 - 1. Standard frame sizes, trip ratings, and number of poles.
 - 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
 - 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
 - 4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
 - 5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Provide a nameplate on each disconnect switch as specified in section 26 05 53 "Identification for Electrical Systems". Nameplate shall show item controlled, voltage, phase, and source of power.

3.02 FIELD QUALITY CONTROL

- A. Equipment installed under this section shall be inspected for defects, and tested for proper operation.
- B. Enclosures and cabinets shall be checked for cleanliness inside and out and for defective or damaged finish.
- C. Systems shall be tested for short circuits, open circuits and wrong connections and shall be free from mechanical and electrical defects.
- D. Bolted connections shall be torque tightened to manufacturer's specifications.
- E. Where required or directed, systems shall be tested in the presence of the District's representative to demonstrate that equipment furnished, installed or connected functions in the manner intended.
- F. Contractor shall furnish all necessary instruments and equipment and all power sources and connections required for making required tests, and shall immediately correct any defective work at no additional charge.

END OF SECTION

SECTION 26 29 13

ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes the following enclosed controllers rated 600V and less:
 - 1. Combination motor controllers
 - 2. Manual motor controllers

1.03 DEFINITIONS

- A. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.
- B. CPT: Control Power Transformer
- C. HOA: Hand-Off-Auto
- D. MCP: Motor Circuit Protector
- E. N.C.: Normally Closed
- F. N.O.: Normally Open

1.04 QUALITY ASSURANCE

- A. Comply with CEC.

1.05 SUBMITTALS

- A. Product Data
 - 1. Material List: A material list with names of manufacturers, model numbers, and technical information on all equipment proposed.
 - 2. Product technical information sheets for each principal component in the proposed system. Identify by arrow, circle or similar means products being proposed. Submittals consisting of unmodified catalog pages with no markings will be rejected.
 - 3. Weight, dimensions and shipping splits.
 - 4. Equipment operating and service (maintenance) clearances required around the equipment.
- B. Shop Drawings

- C. Test Procedures: A written document detailing the proposed test procedures of the system shall be supplied. These procedures shall include all tests required by the equipment manufacturer and by this specification.
- D. Test Results Report: The results of the execution of the testing procedure, including the items tested or inspected, the date, and by whom.
- E. Operating Sequences: Provide a complete written description of the Sequence of Operation of each of the systems including startup and recovery procedures
- F. Samples: when requested by Architect
- G. Operation and Maintenance (O&M) Manuals: Furnish composite "Systems Operation and Maintenance" manuals in indexed three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain, but not be limited to:
 - 1. Operational procedures for the overall systems including the "Sequence of Operation".
 - 2. Test procedures and test results.
 - 3. Instruction for the proper operation and maintenance of the system.
 - 4. Factory issued technical, installation, and maintenance manuals.
 - 5. Factory issued operations and programming (software) manuals.
 - 6. A replacement parts list complete with part numbers and name, address, and phone number of suppliers used by the Contractor. A spare parts list recommended for purchase by the District shall be included.
 - 7. All portions of the material list and shop drawings which are not included in the foregoing.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
 - 1. Cutler-Hammer
 - 2. Siemens
 - 3. Square D
- B. Source Limitations: Obtain materials and accessories from single source from single manufacturer.

2.02 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.
- B. Comply with CEC.

2.03 COMBINATION MOTOR STARTERS - INDIVIDUALLY MOUNTED

- A. Starters used in indoor dry conditions shall have NEMA 1 enclosures. Starters exposed to wet or outdoor conditions shall have non-metallic or stainless steel NEMA 4X enclosures.
- B. Magnetic: Shall be combination starters, NEMA size 0 minimum. Provide with an MCP unless specifically indicated on drawings to be with a fused switch. Provide integral current limiter if necessitated by available fault current. Refer to Single Line Diagram on drawings for fault current values. The combination motor starters shall not be subjected to fault currents exceeding those listed by the manufacturer for the MSCP in combination with the contactor and overload relay.
- C. Provide accessories (start/stop pushbuttons, H.O.A. switches, red neon pilot running lights, interlock contacts, CPT, etc.) as required by this Division and by Division 23 - Mechanical plans and specifications.
- D. Confirm ratings (watts, volts, amps, etc.) with mechanical control system supplier prior to ordering of components. Each starter unit shall, as a minimum, have in its cover an overload reset, H.O.A. selector switch and a red pilot running light. Equip each starter unit with the number of auxiliary N.O. and N.C. contacts required but at least four N.O./N.C. convertible contacts. Equip each starter with an overload relay in each undergrounded wire.

2.04 Select overload ratings to match the characteristics of the motors actually installed. Control voltage shall be 120V except for external mechanical control circuits. Source shall be unit transformers in each starter compartment. Transformer shall be 100VA minimum rating.

MANUAL STARTERS

- A. Toggle type with integral melting alloy overload protection. Where shown on the drawings, fractional horsepower motors shall have toggle type manual starters with thermal overload protection in each phase.
- B. Provide a padlocking device on the handle.
- C. Where the motor is out of sight of the switch provide a pilot light in the cover to indicate switch is closed.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Provide a nameplate for each starter unit indicating the load served (such as "EXH. FAN EF-1") and the source panel and circuit number.

3.02 FIELD QUALITY CONTROL

- A. Equipment installed under this section shall be inspected for defects, and tested for proper operation.
- B. Enclosures and cabinets shall be checked for cleanliness inside and out and for defective or damaged finish.
- C. Systems shall be tested for short circuits, open circuits and wrong connections and shall be free from mechanical and electrical defects.

- D. Bolted connections shall be torque tightened to manufacturer's specifications.
- E. Where required or directed, systems shall be tested in the presence of the District's representative to demonstrate that equipment furnished, installed or connected functions in the manner intended.
- F. Contractor shall furnish all necessary instruments and equipment and all power sources and connections required for making required tests, and shall immediately correct any defective work at no additional charge.

END OF SECTION

SECTION 26 43 13

SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes field-mounted SPDs for low-voltage (120 to 600V) power distribution and control equipment.

1.03 DEFINITIONS

- A. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.
- B. I_{nominal} : Nominal discharge current.
- C. MCOV: Maximum continuous operating voltage.
- D. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies.
- E. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.
- F. OCPD: Overcurrent protective device.
- G. SCCR: Short-circuit current rating.
- H. SPD: Surge protective device.
- I. VPR: Voltage protection rating.

1.04 QUALITY ASSURANCE

- A. Products shall be UL listed and labeled.

1.05 SUBMITTALS

- A. Product Data
 - 1. Material List: A material list with names of manufacturers, model numbers, and technical information on all equipment proposed.
 - 2. Product technical information sheets for each principal component in the proposed system. Identify by arrow, circle or similar means products being proposed. Submittals consisting of unmodified catalog pages with no markings will be rejected.
 - 3. Weight, dimensions and shipping splits.

4. Equipment operating and service (maintenance) clearances required around the equipment.
- B. Shop Drawings
- C. Test Procedures: A written document detailing the proposed test procedures of the system shall be supplied. These procedures shall include all tests required by the equipment manufacturer and by this specification.
- D. Test Results Report: The results of the execution of the testing procedure, including the items tested or inspected, the date, and by whom.
- E. Operating Sequences: Provide a complete written description of the Sequence of Operation of each of the systems including startup and recovery procedures
- F. Operation and Maintenance (O&M) Manuals: Furnish composite "Systems Operation and Maintenance" manuals in indexed three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain, but not be limited to:
 1. Operational procedures for the overall systems including the "Sequence of Operation".
 2. Test procedures and test results.
 3. Instruction for the proper operation and maintenance of the system.
 4. Factory issued technical, installation, and maintenance manuals.
 5. Factory issued operations and programming (software) manuals.
 6. A replacement parts list complete with part numbers and name, address, and phone number of suppliers used by the Contractor. A spare parts list recommended for purchase by the District shall be included.
 7. All portions of the material list and shop drawings which are not included in the foregoing.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
 1. Advanced Protection Technologies Inc. (APT).
 2. Eaton Corporation.
 3. General Electric
 4. LEA International; Protection Technology Group.
 5. Leviton Manufacturing Co., Inc.
 6. Schneider Electric Industries SAS.
 7. Siemens Industry, Inc.
 8. Thomas & Betts (Current Technology)

- B. Source Limitations: Obtain materials and accessories from single source from single manufacturer.

2.02 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.

- B. Comply with CEC.

2.03 SWITCHBOARD SUPPRESSOR

- A. SPDs: Comply with UL 1449, Type 2.

- B. SPDs: Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1449, Type 2

- 1. SPDs with the following features and accessories:

- a. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.

- b. Indicator light display for protection status.

- C. Comply with UL 1283.

- D. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 200 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

- E. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277V and 208Y/120V, three-phase, four-wire circuits shall not exceed the following:

- 1. Line to Neutral: 1200V for 480Y/277V, 700V for 208Y/120V.
 - 2. Line to Ground: 1200V for 480Y/277V, 1200V for 208Y/120V.
 - 3. Line to Line: 2000V for 480Y/277V, 1000V for 208Y/120V.

- F. SCCR: 200kA minimum

- G. I_{nominal} Rating: 20 kA.

2.04 PANEL SUPPRESSORS

- A. SPDs: Comply with UL 1449, Type 2.

- 1. Include LED indicator lights for power and protection status.

- 2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.

- B. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 120 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

- C. Comply with UL 1283.

- D. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277V or 208Y/120V, three-phase, four-wire circuits shall not exceed the following:
 - 1. Line to Neutral: 1200V for 480Y/277V, 700V for 208Y/120V.
 - 2. Line to Ground: 1200V for 480Y/277V, 700V for 208Y/120V.
 - 3. Neutral to Ground: 1200V for 480Y/277V, 700V for 208Y/120V.
 - 4. Line to Line: 2000V for 480Y/277V, 1200V for 208Y/120V
- E. SCCR: Equal or exceed 100 kA.
- F. I_{nominal} Rating: 20 kA.

2.05 ENCLOSURES

- A. Indoor Enclosures: NEMA 250, Type 1.

2.06 CONDUCTORS AND CABLES

- A. Power Wiring: Same size as SPD leads, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install suppressor in accordance with CEC and manufacturer's recommendations.
- B. Suppressor shall be mounted at a location which will minimize the length of leads. The leads shall be made as short and straight as possible. If bends are necessary they shall be long radius. Suppressor location shall be indicated on switchboard and panelboard shop drawings.

END OF SECTION

SECTION 26 51 10

LED INTERIOR LIGHTING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes: LED lighting for the building, and accessories.
- B. Related Sections:
 - 1. Section 26 09 23 LIGHTING CONTROL DEVICES

1.02 SUMMARY

- A. Provide U.L. listed and labeled lighting fixtures complete with lamps at light outlets indicated on the drawings. Each fixture shall bear the U.L. Label, and shall comply with Code Requirements.
- B. Fixtures are listed and described in the Lighting Fixture Schedule and in the following paragraphs. Fixture catalog numbers are to be used as a guide only and shall be understood to be followed by the words "except as modified by the total fixture description both text and pictorial". Provide accessories, features and adaptations necessary to meet the requirements of the description.

1.03 DEFINITIONS

- A. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.
- B. CalGreen: California Green Building Standards, CCR Title 24 Part 11, Chapter 5.

1.04 QUALITY ASSURANCE

- A. Products shall be UL listed and labeled.
- B. Comply with CEC.

1.05 SUBMITTALS

- A. Product Data
 - 1. Material List: A material list with names of manufacturers, model numbers, and technical information on all equipment proposed.
 - 2. Catalog cuts for each fixture including complete photometric data.
 - 3. Weight and dimensions.
 - 4. Product technical information sheets for each principal component in the proposed system. Identify by arrow, circle or similar means products being proposed. Submittals consisting of unmodified catalog pages with no markings will be rejected.

- B. Samples: when requested by Architect.
- C. Operation and Maintenance (O&M) Manuals: Furnish composite "Systems Operation and Maintenance" manuals in indexed three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain, but not be limited to:
 - 1. Operational procedures for the overall systems including the "Sequence of Operation".
 - 2. Test procedures and test results.
 - 3. Instruction for the proper operation and maintenance of the system.
 - 4. Factory issued technical, installation, and maintenance manuals.
 - 5. A replacement parts list complete with part numbers and name, address, and phone number of suppliers used by the Contractor. A spare parts list recommended for purchase by the District shall be included.
 - 6. All portions of the material list and shop drawings which are not included in the foregoing.

1.06 FIELD REPLACEMENT LIGHT ENGINE

- A. Integrate LEDs, driver, power supply, thermal management, and optical mixing components.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by CREE, Inc., email: www.cree.com, Phone (800) 236-6800 or approved equal.

2.02 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.
- B. Comply with CEC.

2.03 CONSTRUCTION MATERIALS

- A. 20 Gauge steel housing, field replaceable light engine, one-piece lower reflector, finishes are textured high reflectance white polyester powder coating.

PART 3 - EXECUTION

3.01 ACCEPTANCE TESTING

- A. Complete the testing and documentation requirements of Title 24 Energy Code Acceptance Testing procedures. Complete and sign the Acceptance Testing Forms and submit to District and DSA Inspector (IOR).

3.02 UTILITY DESIGN INCENTIVE PROGRAM

- A. Furnish the utility company representative with the itemized, paid proof of purchase/invoice for the purchase and installation of energy efficient equipment.
- B. Assist the utility in the verification by utility representative of both the purchase and installation of the energy efficient equipment, including providing the representative access to the Construction Project, at reasonable times, for verification of installation of the equipment.
- C. Provide the utility with a written request for payment of the Incentives calculated, when the Construction Project is completed and occupied.

3.03 CLEANING

- A. After construction of total project is completed:
 - 1. Remove all non-essential labels and other markings.
 - 2. Wash dirty luminaires inside and out with nonabrasive mild soap or cleaner.
 - 3. Clean luminaire plastic lenses with antistatic cleaners only.
 - 4. Touch up all painted surfaces of luminaires and poles with matching paint supplied by manufacturer.

END OF SECTION

SECTION 26 56 00

EXTERIOR LIGHTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Provide lighting fixtures complete with lamps at light outlets indicated on the drawings. Exterior fixtures shall be U.L. listed for damp locations in soffits and for wet locations elsewhere.
- B. Fixtures are listed and described in the Fixture Schedule and in the following paragraphs. Fixture catalog numbers are to be used as a guide only and shall be understood to be followed by the words "except as modified by the total fixture description, both text and pictorial". Provide accessories, features and adaptations necessary to meet the requirements of the description.
- C. Related Requirements:
 - 1. Section 26 09 23 "Lighting Control Devices" for exterior motion sensors and lighting controls.

1.03 DEFINITIONS

- A. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.
- B. CalGreen: California Green Building Standards, CCR Title 24 Part 11, Chapter 5.
- C. HID: High-intensity discharge.
- D. IESNA: Illuminating Engineering Society of North America.

1.04 Spare Parts: Provide the following spare parts to the District upon the completion of the project.

- A. Two of each type of luminaire lens used.

1.05 QUALITY ASSURANCE

- A. Products shall be UL listed and labeled.
- B. Comply with CEC.

1.06 SUBMITTALS

- A. Product Data

1. Material List: A material list with names of manufacturers, model numbers, and technical information on all equipment proposed including each type of lamp and ballast.
 2. Catalog cuts for each fixture and pole including complete photometric data in IES format.
 3. Weight and dimensions.
 4. Product technical information sheets for each principal component in the proposed system. Identify by arrow, circle or similar means products being proposed. Submittals consisting of unmodified catalog pages with no markings will be rejected.
- B. Samples: when requested by Architect.
- C. Operation and Maintenance (O&M) Manuals: Furnish composite "Systems Operation and Maintenance" manuals in indexed three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain, but not be limited to:
1. Operational procedures for the overall systems including the "Sequence of Operation".
 2. Test procedures and test results.
 3. Instruction for the proper operation and maintenance of the system.
 4. Factory issued technical, installation, and maintenance manuals.
 5. Factory issued operations and programming (software) manuals.
 6. A replacement parts list complete with part numbers and name, address, and phone number of suppliers used by the Contractor. A spare parts list recommended for purchase by the District shall be included.
 7. All portions of the material list and shop drawings which are not included in the foregoing.

1.07 FIELD REPLACEMENT LIGHT ENGINE

- A. Integrate LEDs, driver, power supply, thermal management, and optical mixing components.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Source Limitations: Obtain materials and accessories from single source from single manufacturer.
- B. Luminaire shall comply with the following requirements:

1. California Energy Code for Lighting Zones 1-4 as defined by Chapter 10 of the California Administrative Code.
2. Backlight, Uplight and Glare (BUG) ratings as defined by IESNA TM-15-11.
3. Allowable BUG ratings not to exceed those indicated in Table 5.106.8

2.02 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.
- B. Comply with CEC.

2.03 LENSES

- A. Light transmitting plastics:
 1. All plastic shall be 100% virgin acrylic. Pattern #12 lenses shall be minimum 0.125" thick overall with 0.08" prism depth.
- B. Glass:
 1. Glass used for lenses, refractors, and diffusers in incandescent lighting fixtures shall be tempered for high impact and heat resistance; the glass shall be crystal clear in quality with a transmittance of not less than 88%. For exterior fixtures use tempered Borosilicate glass, Corning #7740 or equal. For fixtures directly exposed to the elements and aimed above the horizontal, use Corning Vycor glass or equal.

2.04 SITE LIGHTING LUMINAIRES

- A. Luminaires shall be mounted on poles as shown on the drawings and shall be of the type and manufacturers shown in the schedule or approved equal. Luminaires shall be mounted flat and level, with no tilt or cant.
- B. Luminaires of one type shall be of one manufacturer and of identical finish and appearance.
- C. Site lighting luminaires shall be LED.
- D. LED lighting exterior lighting fixture shall meet the following requirements:
 1. CRI of minimum 80 and CCT of 4100 K
 2. L70 light engine life of 50,000 hours.
 3. Light engine dimmable from 100 percent to 10 percent of maximum light output.
 4. Internal driver.
- E. Flag pole lighting shall be flush mounted in-grade luminaires. Luminaire lens temperature when in operation shall not cause burns to bare skin.
- F. Provide all lamps, ballasts, and mounting hardware required for a complete installation. Mounting hardware shall be completely compatible with, and designed for use with, the proposed pole.

- G. Finish shall be electrostatically applied baked on enamel over a prime coat. Finish shall match poles with no detectable difference under normal viewing conditions. Any minor damages to paint after delivery shall be touched up with paint provided by the manufacturer. Any major paint damage shall be repaired in the factory by the original process.
- H. Provide bird spikes type L53 Nixalite Bird Control or equal (no known equal). Attach to top of luminaires using epoxy adhesive as recommended by bird spike manufacturer.
- I. Submit a computer generated layout of the site showing the illumination levels in footcandles that will result using all proposed fixtures, luminaires, and poles.
- J. Submit catalog cuts and data sheets for each type and wattage proposed. Submittals shall be bound with the pole submittals and shall include complete information on all lamps, ballasts, lenses, and mounting hardware.

2.05 LIGHTING POLES

- A. Poles shall be of the type configuration and height shown on the drawings and shall be provided by the luminaire manufacturer.
- B. Poles 10 feet or longer shall be designed to withstand when installed a wind load of 90 MPH with a gust factor of 1.3. Submittal shall include a statement or other evidence of compliance.
- C. Luminaire mounting provisions shall be designed for complete compatibility with the luminaire to be installed.
- D. Manufacturer shall furnish galvanized steel anchor bolts having an "L" bend. Bolts shall be complete with washers and hex nuts for leveling. Provide a base cover. Hardware up to 8' from the base shall be tamper proof. A handhole or access plate shall be located near the base and shall be reinforced as necessary.
- E. Finish shall be electrostatically applied baked on black enamel prime coat. Finish shall match luminaires with no detectable difference under normal viewing conditions. Any minor damages to paint after delivery shall be touched up with paint provided by the manufacturer. Any major paint damage shall be repaired in the factory by the original process.
- F. Concrete bases (foundations) shall be round, of the size shown on the drawings. Concrete shall [be cast at 3000 psi with reinforcement steel conforming to ASTM A615. Concrete shall conform to ASTM C 33, and shall have a troweled finish with 1 inch chamfered edge. Conform to Section 033000 "Cast-in-Place Concrete."
- G. Poles shall be aligned vertically true with luminaires installed and while no wind is blowing. Base nuts shall be tightened in this position. Bolts in foundations shall be installed in such a way that luminaires on the poles will be facing in the direction shown on the drawings. Luminaires shall be bolted to the poles and adjusted so that the luminaires lens will be perfectly horizontal or tilted to the exact angle specified.
- H. Take all necessary precautions against damaging existing and new surfaces, structures and other work on the site during handling and erection of poles. Provide barriers to keep others at a safe distance during excavation, erection and assembly.

- I. Provide outdoor ground mounted poles or floodlight units with concrete bases, either as detailed or, if not detailed, as recommended by the manufacturer. Fixtures mounted directly on conduit as supports, such as floodlights on grade, shall have a minimum 8 inch cube of concrete at or below grade to anchor fixture.
- J. Provide non-metallic bolt cover in finish to match pole.

PART 3 - EXECUTION

3.01 LIGHTING POLE BASES (FOUNDATIONS)

- A. Increase the diameter of the base as necessary to provide a 1½ inch minimum space between the flange cover and the base perimeter.
- B. Carefully clean out the edges and corners at the bottom of the excavations to give a level compacted floor for the bases. Shape the base by forms from the top down to 6 inches below grade.
- C. Conduits and anchor bolts shall be held in place with templates or other approved means during placing of concrete, and shall rise vertically into the top of the base. Carefully coordinate the conduit and anchor bolts with the rebar cage prior to fabrication of rebar cage.
- D. Provide a ½ inch chamfer around the perimeter of the top of the base and dress the green concrete (sides and top) with a sacking finish. Top surface shall be dead level so the flange of the pole can bear directly against the concrete. Stainless steel shims may be used for minor adjustments required to make the pole plumb but they shall have adequate bearing area against the concrete and shall not extend beyond the flange cover.
- E. If the double nut method of plumb adjustment is used, the bottom nuts shall be set-in flush with the top of base with only enough block out around each nut to allow it to spin upward. At completion of plumb adjustment a portion of the edge of flange shall touch the concrete. The space between the flange and the concrete shall be grouted. Provide a weep hole through the grout to allow water to drain from the pole base.
- F. If the flange cover setscrews do not bear against the flange because of excessive plumb adjustment, secure an extension piece to the underside of flange to give a solid bearing surface for the set screws.

3.02 ACCEPTANCE TESTING

- A. Complete the testing and documentation requirements of Title 24 Energy Code Acceptance Testing procedures. Complete and sign the Acceptance Testing Forms and submit to District and DSA Inspector (IOR).

3.03 UTILITY DESIGN INCENTIVE PROGRAM

- A. Contractor shall furnish the utility company representative with the itemized, paid proof of purchase/invoice for the purchase and installation of energy efficient equipment.
- B. To assist the utility in the verification by utility representative of both the purchase and installation of the energy efficient equipment, including providing the representative access to the Construction Project, at reasonable times, for verification of installation of the equipment.

- C. To provide the utility with a written request for payment of the Incentives calculated, when the Construction Project is completed and occupied.

3.04 CLEANING

- A. After construction of total project is completed:
 - 1. Remove all non-essential labels and other markings.
 - 2. Wash dirty luminaires inside and out with nonabrasive mild soap or cleaner.
 - 3. Clean luminaire plastic lenses with antistatic cleaners only.
 - 4. Touch up all painted surfaces of luminaires and poles with matching paint supplied by manufacturer.

END OF SECTION

SECTION 27 05 26

GROUNDING AND BONDING FOR TELECOMMUNICATIONS SYSTEMS

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. All applicable portions of Division 26, Division 27, and Division 28 shall apply to this section as though written herein completely.

1.2 SUMMARY

- A. Section Includes:
 - 1. Grounding conductors.
 - 2. Grounding connectors.
 - 3. Grounding busbars.
 - 4. Grounding labeling.

1.3 SCOPE OF WORK

- A. The work described by this part includes the furnishing of all materials, equipment, supplies, labor and the performing of all operations necessary for the installation of complete and operating systems.
- B. Contractor shall provide District with all packing slips and receipts for all equipment over \$500. This equipment requires a G-number for District tracking. Contractor is responsible for coordinating with CM, PM and site MSF for delivery of all equipment.

1.4 RELATED WORK

- A. Document affecting work of this section include, but are not necessarily limited to, General Conditions, Supplementary Conditions and sections of Divisions 1 and 26 of these specifications.

1.5 QUALIFICATIONS

- A. The Installing Electronic Systems Contractor shall hold a valid State of California C-7 license for all low voltage installations and a State of California C-10 License for any related high-voltage applications and shall have completed at least twenty projects including five projects with

Grossmont Union High School District of equal scope, shall have been in business of furnishing and installing communication systems of this type for at least ten years, and capable of being bonded to assure the District of performance and satisfactory service during the guarantee period.

- B. The Installing Electronic Systems 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 Contractor shall maintain a spare set of all major parts for the system at all times.

1.6 DEFINITIONS

- A. BCT: Bonding conductor for telecommunications.
- B. BDF: Building Distribution Frame
- C. BICSI: Building Industry Consulting Service International.
- D. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.
- E. EMT: Electrical metallic tubing.
- F. IDF: Intermediate Distribution Frame
- G. MDF: Main Distribution Frame
- H. LAN: Local area network.
- I. RCDD: Registered Communications Distribution Designer.
- J. TGB: Telecommunications grounding busbar.
- K. TMGB: Telecommunications main grounding busbar.

1.7 APPLICABLE STANDARDS

- A. The equipment shall be U.L. listed labeled, and approved for the application shown in the contract documents.
- B. The complete system material, equipment, testing, installation and workmanship shall comply with requirements of:
 - 1. The Contract Documents.
 - 2. ANSI/TIA 568 Commercial Building Telecommunications Standards (Current Editions, including all applicable revisions, addendums and errata's.)
 - 3. ANSI/EIA/TIA-569 Commercial Building Standard for Telecommunications Pathways and Spaces (Current Edition, including all applicable revisions, addendums and errata's.)
 - 4. ANSI/EIA/TIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings – All applicable revisions and addendums.

5. J-STD-607-B Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications (Current Edition, including all applicable revisions, addendums and errata's.)
6. Building Industries Consulting Services, International (BICSI) Telecommunications Distribution Methods Manual (TDMM) (Current Edition, including all applicable revisions, addendums and errata's.)
7. CEC (Current Edition, including all applicable revisions, addendums and errata's.)

1.8 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For communications equipment room signal reference grid. Include plans, elevations, sections, details, and attachments to other work.
 1. Include dimensioned plan and elevation views of telecommunications equipment rooms, labeling each individual component. Show equipment rack assemblies, method of field assembly, workspace requirements, and access for cable connections.
 2. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by District.
 3. Cabling Administration Drawings.

1.9 INFORMATIONAL SUBMITTALS

- A. Submit references for a minimum of twenty similar projects successfully undertaken and completed within the last ten years. As a minimum, provide project name and address, client contact name and telephone number, and construction manager name and telephone number. Provide a brief description of each project indicating types of systems installed, quantities and configurations of outlets, and projected time scales.
- B. As-Built Data: Plans showing as-built locations of grounding and bonding infrastructure, including the following:
 1. BCT, TMGB, TGBs, and routing of their bonding conductors.
- C. Qualification Data: For Installer.
- D. Qualification Data: For testing agency and testing agency's field supervisor.
- E. Field quality-control reports.

1.10 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
 - a. Result of the ground-resistance test, measured at the point of BCT connection.
 - b. Result of the bonding-resistance test at each TMGB/TGB and its nearest grounding electrode.

1.11 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 1. Installation Supervision: Installation shall be under the direct supervision of ITS Installer 2, who shall be present at all times when Work of this Section is performed at Project site.
 2. Field Inspector: Currently registered by BICSI as a registered communications distribution designer to perform the on-site inspection.
 3. Products, services, and materials provided by the Contractor shall be new and of high quality and free of faults and defects.
 4. Provide products, services, and materials as specified in this document. Substitution of products, services, or materials will only be considered if the Contractor follows procedures and requirements specified in Division 1.
 5. Contractor shall warranty all work executed and materials furnished shall be free from defects of material and workmanship for a period of two (2) years from acceptance date of Contract Completion. Immediately upon receipt of written notice from the District, Contractor shall repair or replace at no expense to the District: Any defective material or work which may be discovered before final acceptance or work, or within warranty period; any material or work damaged thereby; and adjacent material or work which may be displaced in repair or replacement.
 6. Examination of or failure to examine work by the District shall not relieve Contractor from these obligations.
 7. If Contractor fails to repair or replace material or work indicated above within 7 days of receiving written notice, the District, with its own personnel or by Contract, may proceed with repair or replacement and assess cost against Contractor, if Contractor does not respond accordingly.
 8. Persons skilled in trade shall install system in accordance with best trade practice. Further, in accordance with all applicable building codes. Contractor and all contractors' employees terminating cable to wiring terminating devices shall be certified by the manufacturer of the wiring device. Copies of certificates shall be provided to the District Representative prior to the start of work.

PART 2 - PRODUCTS

2.1 SYSTEM COMPONENTS

- A. Comply with J-STD-607-B.

2.2 CONDUCTORS

- 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. Harger Lightning and Grounding.
 - 2. Panduit Corp.
 - 3. Tyco Electronics Corp.
- B. Comply with UL 486A-486B.
- C. Insulated Conductors: Stranded copper wire, green or green with yellow stripe insulation, insulated for 600 V, and complying with UL 83.
 - 1. Ground wire for custom-length equipment ground jumpers shall be No. 6 AWG, 19-strand, UL-listed, Type THHN wire.
 - 2. Cable Tray Equipment Grounding Wire:
 - a. No. 6 AWG.
 - b. Not longer than 12 inches (300 mm). The jumper shall be a wire and shall have a crimped grounding lug with two holes and long barrel for two crimps. Attach with grounding screw or connector provided by cable tray manufacturer.
- D. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.

2.3 CONNECTORS

- A. Irreversible connectors listed for the purpose. Listed by an NRTL as complying with NFPA 70 for specific types, sizes, and combinations of conductors and other items connected. Comply with UL 486A-486B.
- B. 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. Burndy; Part of Hubbell Electrical Systems.
 - 2. Chatsworth Products, Inc.
 - 3. Harger Lightning and Grounding.
 - 4. Panduit Corp.
 - 5. Tyco Electronics Corp.
- C. Compression Wire Connectors: Crimp-and-compress connectors that bond to the conductor when the connector is compressed around the conductor. Comply with UL 467.

1. Electroplated tinned copper, C and H shaped.
- D. Signal Reference Grid Connectors: Combination of compression wire connectors, access floor grounding clamps, bronze U-bolt grounding clamps, and copper split-bolt connectors, designed for the purpose.
- E. Busbar Connectors: Cast silicon bronze, solderless compression or exothermic-type, mechanical connector; with a long barrel and two holes spaced on 5/8- or 1-inch (15.8- or 25.4-mm) centers for a two-bolt connection to the busbar.
- F. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.4 GROUNDING BUSBARS

- 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. Chatsworth Products, Inc.
 2. Harger Lightning and Grounding.
 3. Panduit Corp.
- B. TGB: Predrilled rectangular bars of hard-drawn solid copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, length as indicated on Drawings. The busbar shall be for wall mounting, shall be NRTL listed as complying with UL 467, and shall comply with J-STD-607-B.
 1. Predrilling shall be with holes for use with lugs specified in this Section.
 2. Mounting Hardware: Stand-off brackets that provide at least a 2-inch (50-mm) clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.)
 3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.
- C. Rack and Cabinet Grounding Busbars: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and complying with J-STD-607-B.
 1. Predrilling shall be with holes for use with lugs specified in this Section.
 2. Cabinet-Mounted Busbar: Terminal block, with stainless-steel or copper-plated hardware for attachment to the cabinet.
 3. Rack-Mounted Horizontal Busbar: Designed for mounting in 19-inch (483-mm) equipment racks. Include a copper splice bar for transitioning to an adjoining rack, and stainless-steel or copper-plated hardware for attachment to the rack.

2.5 LABELING

- 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. Brother International Corporation.
 - 2. HellermannTyton.
 - 3. Panduit Corp.
- B. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the ac grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of the electrical system.
- B. Inspect the test results of the ac grounding system measured at the point of BCT connection.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

3.2 INSTALLATION

- A. Comply with NECA 1.
- B. Comply with J-STD-607-B.
- C. All racks, cabinets, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, etc. entering or residing in the Telecommunication Room or Equipment Room shall be grounded to the respective TGB or TMGB using a minimum #6 AWG stranded copper bonding conductor and compression connectors. Where metallic panels attached to the rack do not have sufficient metal to metal contact to provide an adequate path to ground, they shall be bonded to the rack using a minimum #12 AWG copper conductor. The copper conductor size shall be upgraded based on the largest power conductor feeding any rack-mount equipment. The conductor shall be continuous; attaching all isolated components in a daisy chain fashion from top to bottom and bonded to the rack using an appropriate compression connector.
- D. All wires used for telecommunications grounding purposes shall be identified with green insulation. Non-insulated wires shall be identified at each termination point with a wrap of green

tape. All cables and bus bars shall be identified and labeled in accordance with the System Documentation Section of this specification

3.3 APPLICATION

- A. Conductors: Install solid conductor for No. 8 AWG and smaller and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Conductor Terminations and Connections:
 - 1. Equipment Grounding Conductor Terminations: Bolted connectors.
- C. Conductor Support:
 - 1. Secure grounding and bonding conductors at intervals of not less than 36 inches (900 mm).
- D. Grounding and Bonding Conductors:
 - 1. Install in the straightest and shortest route between the origination and termination point, and no longer than required. The bend radius shall not be smaller than eight times the diameter of the conductor. No one bend may exceed 90 degrees.
 - 2. Install without splices.
 - 3. Support at not more than 36-inch (900-mm) intervals.
 - 4. Conductors shall not be installed in EMT unless otherwise indicated.

3.4 CONNECTIONS

- A. Bond metallic equipment in a telecommunications equipment room to the grounding busbar in that room, using equipment grounding conductors not smaller than No. 6 AWG.
- B. Stacking of conductors under a single bolt is not permitted when connecting to busbars.
- C. Assemble the wire connector to the conductor, complying with manufacturer's written instructions and as follows:
 - 1. Use crimping tool and the die specific to the connector.
 - 2. Pretwist the conductor.
 - 3. Apply an antioxidant compound to all bolted and compression connections.
- D. Primary Protector: Bond to the TMGB with insulated bonding conductor.
- E. Telecommunications Enclosures and Equipment Racks: Bond metallic components of enclosures to the telecommunications bonding and grounding system. Install top-mounted rack grounding busbar unless the enclosure and rack are manufactured with the busbar. Bond the equipment grounding busbar to the TGB No. 6 AWG bonding conductors.
- F. Shielded Cable: Bond the shield of shielded cable to the TGB in communications rooms and spaces. Comply with TIA/EIA-568-B.1 and TIA/EIA-568-B.2 when grounding screened, balanced, twisted-pair cables.

- G. Rack- and Cabinet-Mounted Equipment: Bond powered equipment chassis to the cabinet or rack grounding bar. Power connection shall comply with NFPA 70; the equipment grounding conductor in the power cord of cord- and plug-connected equipment shall be considered as a supplement to bonding requirements in this Section.

3.5 IDENTIFICATION

- A. Labels shall be preprinted or computer-printed type.
 - 1. Label each telecommunications conductor at its attachment point: "WARNING! TELECOMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!"

3.6 FIRESTOP SYSTEMS

- A. A firestop system is comprised of the item or items penetrating the fire rated structure; the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, heat, vapor and pressurized water stream.
- B. All penetrations through fire rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating items i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly firestopped.
- C. Firestop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE, licensed (actual or reciprocal) in the state where the work is to be performed. A drawing showing the proposed firestopped system, stamped/embossed by the cognizant PE shall be provided to the District's Technical Representative prior to installing the firestop system.
- D. All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.

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 physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

2. Test the bonding connections of the system using an AC earth ground-resistance tester, taking two-point bonding measurements in each telecommunications equipment room containing a TMGB and a TGB and using the process recommended by BICSI TDMM. Conduct tests with the facility in operation.
 - a. Measure the resistance between the busbar and the nearest available grounding electrode. The maximum acceptable value of this bonding resistance is 100 milliohms.
 3. Test for ground loop currents using a digital clamp-on ammeter, with a full-scale of not more than 10 A, displaying current in increments of 0.01 A at an accuracy of plus/minus 2.0 percent.
 - a. With the grounding infrastructure completed and the communications system electronics operating, measure the current in every conductor connected to the TMGB. Maximum acceptable ac current level is 1 A.
- D. Excessive Ground Resistance: If resistance to ground at the BCT exceeds 5 ohms, notify Architect promptly and include recommendations to reduce ground resistance.
- E. Grounding system will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

3.8 CLEANING AND PROTECTION

- A. The contractor shall thoroughly clean all equipment and materials. All exposed parts of the equipment, cabinets, and other equipment shall be left in a clean condition, unblemished and free of all dirt, dust, smudges, spots, fingerprints, etc., The contractor shall remove all debris and rubbish occasioned by the electronic systems work from the site. The contractor shall thoroughly clean all buildings of any dirt, debris, rubbish, marks, etc., caused by the performance of this work.

3.9 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 District.
- B. The contractor shall maintain a competent service organization and shall, if requested, submit a service maintenance agreement to the District after the end of the guarantee period.
- C. A typewritten notice shall be posted at the equipment rack which shall indicate the firm, address and telephone number to call when service is necessary. The notice shall be mounted in a neatly finished metal frame with a clear plastic window and securely attached to the inside of the door.
- D. Special Warranty

1. The contractor shall warrant the cabling system against defects in workmanship for a period of one year from the date of system acceptance. The warranty shall cover all labor and materials necessary to correct a failed portion of the system and to demonstrate performance within the original installation specifications after repairs are accomplished. All warranty repairs shall be done within fourteen days from being notified in writing by the District. This warranty shall be provided at no additional cost to the District.

END OF SECTION 270526

SECTION 270536

CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

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. All applicable portions of Division 26, Division 27, and Division 28 shall apply to this section as though written herein completely.

1.2 SUMMARY

- A. Section Includes:
 - 1. Ladder cable trays.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of cable tray.
 - 1. Include data indicating dimensions and finishes for each type of cable tray indicated.
- B. Shop Drawings: For each type of cable tray.
 - 1. Show fabrication and installation details of cable trays, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans and sections, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Include scaled cable tray layout and relationships between components and adjacent structural, electrical, and mechanical elements.
 - 2. Vertical and horizontal offsets and transitions.
 - 3. Clearances for access above and to side of cable trays.
 - 4. Vertical elevation of cable trays above the floor or below bottom of ceiling structure.
- B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR CABLE TRAYS

- A. Cable Trays and Accessories: Identified as defined in NFPA 70 and marked for intended location, application, and grounding.
 - 1. Source Limitations: Obtain cable trays and components from single manufacturer.
- B. Structural Performance: See articles for individual cable tray types for specific values for the following parameters:
 - 1. Uniform Load Distribution: Capable of supporting a uniformly distributed load on the indicated support span when supported as a simple span and tested according to NEMA VE 1.
 - 2. Concentrated Load: A load applied at midpoint of span and centerline of tray.
 - 3. Load and Safety Factors: Applicable to both side rails and rung capacities.

2.2 LADDER CABLE TRAYS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2. MonoSystems, Inc.
 - 3. MP Husky USA Cable Tray & Cable Bus.
 - 4. Or Equal
- B. Description:
 - 1. Configuration: Two I-beam side rails with transverse rungs welded to side rails.
 - 2. Rung Spacing: 9 inches O.C.
 - 3. Radius-Fitting Rung Spacing: 9 inches at center of tray's width.
 - 4. Minimum Cable-Bearing Surface for Rungs: 7/8-inch width with radius edges.
 - 5. No portion of the rungs shall protrude below the bottom plane of side rails.
 - 6. Structural Performance of Each Rung: Capable of supporting a maximum cable load, with a safety factor of 1.5, plus a 200-lb concentrated load, when tested according to NEMA VE 1.
 - 7. Minimum Usable Load Depth: 3 inches.
 - 8. Straight Section Lengths: 10 feet except where shorter lengths are required to facilitate tray assembly.
 - 9. Width: 12 inches unless otherwise indicated on Drawings.
 - 10. Fitting Minimum Radius: 12 inches.
 - 11. Class Designation: Comply with NEMA VE 1, Class 12B.
 - 12. Splicing Assemblies: Bolted type using serrated flange locknuts.
 - 13. Hardware and Fasteners: Steel, zinc plated according to ASTM B 633.
 - 14. Splice Plate Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.

2.3 MATERIALS AND FINISHES

A. Steel:

1. Straight Section and Fitting Side Rails and Rungs: Steel complies with the minimum mechanical properties of ASTM A 1011/A 1011M, SS, Grade 33.
2. Steel Tray Splice Plates: ASTM A 1011/A 1011M, HSLAS, Grade 50, Class 1.
3. Fasteners: Steel complies with the minimum mechanical properties of ASTM A 510/A 510M, Grade 1008.
4. Finish: Mill galvanized before fabrication.
 - a. Standard: Comply with ASTM A 653/A 653M, G90.
 - b. Hardware: Chromium-zinc plated, ASTM F 1136.
5. Finish: Electrogalvanized before fabrication.
 - a. Standard: Comply with ASTM B 633.
 - b. Hardware: Galvanized, ASTM B 633.
6. Finish: Hot-dip galvanized after fabrication.
 - a. Standard: Comply with ASTM A 123/A 123M, Class B2.
 - b. Hardware: Chromium-zinc plated, ASTM F 1136.
7. Finish: Epoxy-resin paint.
 - a. Powder-Coat Enamel: Cable tray manufacturer's recommended primer and corrosion-inhibiting treatment, with factory-applied powder-coat paint.
 - b. Epoxy-Resin Prime Coat: Cold-curing epoxy primer, MPI# 101.
 - c. Epoxy-Resin Topcoat: Epoxy, cold-cured, gloss, MPI# 77.
 - d. Hardware: Chromium-zinc plated, ASTM F 1136.
8. Finish: Factory-standard primer, ready for field painting, with chromium-zinc-plated hardware according to ASTM F 1136.
9. Finish: Black oxide finish for support accessories and miscellaneous hardware according to ASTM D 769.

B. Aluminum:

1. Materials: Alloy 6063-T6 according to ANSI H 35.1/H 35.1M for extruded components and Alloy 5052-H32 according to ANSI H 35.1/H 35.1M for fabricated parts.
2. Hardware: Chromium-zinc-plated steel, ASTM F 1136.
3. Hardware for Aluminum Cable Tray Used Outdoors: Stainless steel, Type 316, ASTM F 593 and ASTM F 594.

2.4 CABLE TRAY ACCESSORIES

- ### A. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.

- B. Barrier Strips: Same materials and finishes as for cable tray.
- C. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

2.5 WARNING SIGNS

- A. Lettering: 1-1/2-inch-high, black letters on yellow background with legend "Warning! Not To Be Used as Walkway, Ladder, or Support for Ladders or Personnel."
- B. Comply with requirements for fasteners in Section 260553 "Identification for Electrical Systems."

2.6 SOURCE QUALITY CONTROL

- A. Testing: Test and inspect cable trays according to NEMA VE 1.

PART 3 - EXECUTION

3.1 CABLE TRAY INSTALLATION

- A. Install cable trays according to NEMA VE 2.
- B. Install cable trays as a complete system, including fasteners, hold-down clips, support systems, barrier strips, adjustable horizontal and vertical splice plates, elbows, reducers, tees, crosses, cable dropouts, adapters, covers, and bonding.
- C. Install cable trays so that the tray is accessible for cable installation and all splices are accessible for inspection and adjustment.
- D. Remove burrs and sharp edges from cable trays.
- E. Join aluminum cable tray with splice plates; use four square neck-carriage bolts and locknuts.
- F. Fasten cable tray supports to building structure.
- G. Design fasteners and supports to carry cable tray, the cables, and a concentrated load of 200 lb. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems." Comply with seismic-restraint details according to Section 260548.16 "Seismic Controls for Electrical Systems."
- H. Place supports so that spans do not exceed maximum spans on schedules and provide clearances shown on Drawings. Install intermediate supports when cable weight exceeds the load-carrying capacity of the tray rungs.
- I. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer. Arrange supports in trapeze or wall-bracket form as required by application.

- J. Support bus assembly to prevent twisting from eccentric loading.
- K. Install center-hung supports for single-rail trays designed for 60 versus 40 percent eccentric loading condition, with a safety factor of 3.
- L. Locate and install supports according to NEMA VE 2. Do not install more than one cable tray splice between supports.
- M. Make connections to equipment with flanged fittings fastened to cable trays and to equipment. Support cable trays independent of fittings. Do not carry weight of cable trays on equipment enclosure.
- N. Install expansion connectors where cable trays cross building expansion joints and in cable tray runs that exceed dimensions recommended in NEMA VE 2. Space connectors and set gaps according to applicable standard.
- O. Make changes in direction and elevation using manufacturer's recommended fittings.
- P. Make cable tray connections using manufacturer's recommended fittings.
- Q. Seal penetrations through fire and smoke barriers. Comply with requirements in Section 078413 "Penetration Firestopping."
- R. Install capped metal sleeves for future cables through firestop-sealed cable tray penetrations of fire and smoke barriers.
- S. Install cable trays with enough workspace to permit access for installing cables.
- T. Install barriers to separate cables of different systems, such as power, communications, and data processing; or of different insulation levels, such as 600, 5000, and 15 000 V.
- U. Install warning signs in visible locations on or near cable trays after cable tray installation.

3.2 CABLE TRAY GROUNDING

- A. Ground cable trays according to NFPA 70 unless additional grounding is specified. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems."
- B. Cable trays with communications cable shall be bonded together with splice plates listed for grounding purposes or with listed bonding jumpers.
- C. Cable trays with control conductors shall be bonded together with splice plates listed for grounding purposes or with listed bonding jumpers.
- D. When using epoxy- or powder-coat painted cable trays as a grounding conductor, completely remove coating at all splice contact points or ground connector attachment. After completing splice-to-grounding bolt attachment, repair the coated surfaces with coating materials recommended by cable tray manufacturer.

- E. Bond cable trays to power source for cables contained within with bonding conductors sized according to NFPA 70, Article 250.122, "Size of Equipment Grounding Conductors."

3.3 CABLE INSTALLATION

- A. Install cables only when each cable tray run has been completed and inspected.
- B. Fasten cables on horizontal runs with cable clamps or cable ties according to NEMA VE 2. Tighten clamps only enough to secure the cable, without indenting the cable jacket. Install cable ties with a tool that includes an automatic pressure-limiting device.
- C. Fasten cables on vertical runs to cable trays every 18 inches.
- D. Fasten and support cables that pass from one cable tray to another or drop from cable trays to equipment enclosures. Fasten cables to the cable tray at the point of exit and support cables independent of the enclosure. The cable length between cable trays or between cable tray and enclosure shall be no more than 72 inches.
- E. Tie MI cables down every 36 inches where required to provide a 2-hour fire rating and every 72 inches elsewhere.
- F. In existing construction, remove inactive or dead cables from cable trays.

3.4 CONNECTIONS

- A. Remove paint from all connection points before making connections. Repair paint after the connections are completed.
- B. Connect pathways to cable trays according to requirements in NEMA VE 2.

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. After installing cable trays and after electrical circuitry has been energized, survey for compliance with requirements.
 - 2. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable trays, vibrations, and thermal expansion and contraction conditions, which may cause or have caused damage.
 - 3. Verify that the number, size, and voltage of cables in cable trays do not exceed that permitted by NFPA 70. Verify that communications or data-processing circuits are separated from power circuits by barriers or are installed in separate cable trays.
 - 4. Verify that there are no intruding items such as pipes, hangers, or other equipment in the cable tray.
 - 5. Remove dust deposits, industrial process materials, trash of any description, and any blockage of tray ventilation.

6. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorque in suspect areas.
7. Check for improperly sized or installed bonding jumpers.
8. Check for missing, incorrect, or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
9. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable trays. Test entire cable tray system for continuity. Maximum allowable resistance is 1 ohm.

B. Prepare test and inspection reports.

3.6 PROTECTION

A. Protect installed cable trays and cables.

1. Install temporary protection for cables in open trays to safeguard exposed cables against falling objects or debris during construction. Temporary protection for cables and cable tray can be constructed of wood or metal materials and shall remain in place until the risk of damage is over.
2. Repair damage to galvanized finishes with zinc-rich paint recommended by cable tray manufacturer.
3. Repair damage to paint finishes with matching touchup coating recommended by cable tray manufacturer.

END OF SECTION 270536

SECTION 271100

COMMUNICATIONS EQUIPMENT ROOM FITTINGS

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. All applicable portions of Division 26, Division 27, and Division 28 shall apply to this section as though written herein completely.

1.2 SUMMARY

- A. Section Includes:
 - 1. Telecommunications mounting elements.
 - 2. Backboards.
 - 3. Telecommunications equipment racks and cabinets.
 - 4. Grounding.

1.3 SCOPE OF WORK

- A. The work described by this part includes the furnishing of all materials, equipment, supplies, labor and the performing of all operations necessary for the installation of complete and operating systems.
- B. All conduits, outlet boxes, back boxes, junction boxes, terminal cabinets, backboards, wiring, cables, equipment, devices, etc. unless existing, shall be furnished and installed complete under this section. Conduit and junction box sizes shall be determined by the Installing Electrical Contractor for the particular wire and cable fills required for the systems installed. (Conduit sizes shall comply with the California Electrical Code.) The entire responsibility of the system, including the installation, operation, function, testing and maintenance for one (1) year after final acceptance under this section shall be the responsibility of the installing electronic contractor.
- C. The Installing Electronic Systems Contractor shall furnish and install all equipment, cables, devices, and other materials even though not specifically mentioned herein, which are necessary for the proper integration of the system so that the system shall perform the functions listed herein in compliance with all specified requirements.
- D. Contractor shall provide District with all packing slips, and receipts for all equipment over \$500. This equipment requires a G-number for District tracking. Contractor is responsible for coordinating with CM, PM and site MSF for delivery of all equipment.

1.4 DEFINITIONS

- A. Backbone: A facility (e.g., pathway, cable, or conductors) between telecommunications rooms or floor distribution terminals, the entrance facilities, and the equipment rooms within or between buildings.
- B. BDF: Building Distribution Frame (same location as MDF)
- C. BICSI: Building Industry Consulting Service International.
- D. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.
- E. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- F. EMI: Electromagnetic interference.
- G. Horizontal Cabling: Cabling between and including the telecommunications outlet/connector and the horizontal cross-connect. Also the cabling between and including the building automation system outlet or the first mechanical terminations on the horizontal connection point and the horizontal cross-connect.
- H. IDC: Insulation displacement connector.
- I. IDF: Intermediate Distribution Frame
- J. LAN: Local area network.
- K. MDF: Main Distribution Frame
- L. MTR: Main Telephone Room
- M. RCDD: Registered Communications Distribution Designer.
- N. RMC: Rigid metallic conduit.
- O. UTP: Un-shielded twisted pair cable.

1.5 APPLICABLE STANDARDS

- A. The equipment shall be U.L. listed labeled, and approved for the application shown in the contract documents.
- B. The complete system material, equipment, testing, installation and workmanship shall comply with requirements of:
 - 1. This Technical Specification and Associated Drawings.
 - 2. ANSI/TIA 568-C.0 Generic Telecommunications Cabling for Customer Premises
 - 3. ANSI/TIA 568-C.1 Commercial Building Telecommunications Cabling Standard

4. ANSI/TIA 568-C.2 Balanced Twisted-Pair Telecommunications Cabling and Components Standards
5. ANSI/TIA 568-C.3 Optical Fiber Cabling Components Standard
6. EIA/TIA-TSB-36 Technical Systems Bulletin, Additional Cable Specifications for Unshielded Twisted-Pair Cables-November, 1991 and all applicable revisions and addendums.
7. TIA/EIA-TSB-40 Telecommunications Systems Bulletin, Additional Transmission Specifications for Unshielded-Pair Connecting Hardware – January, 1994 and all applicable revisions and addendums.
8. TIA/EIA-TSB-75 Telecommunications System Bulletin, Additional Transmission Specifications for Unshielded Twisted-Pair consolidation points and cabling – January, 1997 and all applicable revisions and addendums.
9. ANSI/EIA/TIA-569 Commercial Building Standard for Telecommunications Pathways and Spaces – October 1990 and all applicable revisions and addendums.
10. ANSI/EIA/TIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings – February 1993 and all applicable revisions and addendums.
11. J-STD-607-A Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications – October 2002 and all applicable revisions and addendums.
12. Building Industries Consulting Services, International (BICSI) Telecommunications Distribution Methods Manual (TDMM)-2000 and all applicable revisions and addendums.
13. TIA TSB62-23 Telecommunications Systems Bulletin, Measurement of the Non-linear coefficient of single-mode fibers – January 2003 and all applicable revisions and or addendums to these documents.
14. CEC (Current Edition, including all applicable revisions, addendums and errata's.)

1.6 QUALIFICATIONS

- A. The installing Electronic Systems Contractor must be a CommScope (AMP) NETCONNECT PartnerPro certified contractor. Provide a copy of Contractor's CommScope AMP NETCONNECT certification with bid package. The Installing Electronic Contractor shall be an authorized CommScope AMP NETCONNECT PartnerPro business partner and shall provide 25 years extended product warranty and application assurance on this installation.
- B. The supplier of the equipment shall be an authorized CommScope (AMP) NETCONNECT PartnerPro distributor and service facility.
- C. The Installing Electronic Systems Contractor shall hold a valid State of California C-7 license for all low voltage installations and a State of California C-10 License for any related high-voltage applications and shall have completed at least twenty projects including five projects with Grossmont Union High School District of equal scope, shall have been in business of furnishing and installing communication systems of this type for at least ten years, and capable of being bonded to assure the District of performance and satisfactory service during the guarantee period.

- D. The Installing Electronic Systems Contractor shall be a factory authorized distributor and warranty 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 Contractor shall maintain a spare set of all major parts for the system at all times. All circuit boards, amplifiers and control sub systems shall be 100% backed up with stock at contractor's shop.
- E. Extend material and Performance Warranties.
1. The contractor shall facilitate and extend to the District all manufacturers' warranties for all products installed. Extended system (performance) and component warranties shall be provided which warrants functionality of all existing and new components (cable, connecting hardware and patch cords) used in the system for a minimum of (25) twenty-five years from the date of acceptance. Each component of the system shall be covered for defects in materials and workmanship. Copper links shall be warranted against the link performance minimum expected results defined in the TIA/EIA SP-2840A, Annex E. Fiber optic links shall be warranted against the link and segment performance minimum expected results defined in the TIA/EIA SP-2840A, Annex H. All fiber and copper cabling, termination components, and ancillary devices shall be of one manufacturer to insure no disputes can arise between different manufacturers if performance problems arise. Installers shall be factory trained technicians with a factory trained supervisor overseeing the project.
 2. Warranty scope includes, but is not limited to, network cables and terminations, network workstation plug-in outlets, and patch panel plug-in outlets, cable splices and connectors.
 3. Repair or replace the defective material at the project premise, to comply with the performance standards outlined in the contract documents during the warranty period.
 4. All newly installed fiber optic cabling and any existing fiber optic cabling which was disconnected/reconnect during the course of this project shall require complete link test in accordance with the testing requirements specified elsewhere in this document, and require a CommScope AMP NETCONNECT 25-Year EWP warranty.
 5. In addition to the manufacturer warranties, the Contractor shall provide their own 2-year warranty covering all aspects of the project to include workmanship.
 6. Upon successful completion of the installation and subsequent inspection, the District's Project Manager shall be provided with a numbered certificate, from the manufacturing company, registering the installation.
 7. All conditions for obtaining the manufacturer's warranty shall be the sole responsibility of the contractor.
- F. The structured cabling system shall be a CommScope AMP NETCONNECT end-to-end solution. No equal. All equipment must be approved by District (Technology and Information Services).

1.7 ACTION SUBMITTALS

- A. Provide three (3) full-size installation samples of the voice, data and IP speaker-clock system outlet. The sample shall include, as a minimum, the faceplate, two data and two voice system connectors (each terminated with a 12" length of distribution cabling) two blanking plates, and back boxes.
- B. Shop Drawings:
 - 1. Include dimensioned plan and elevation views of telecommunications equipment rooms, labeling each individual component. Show equipment rack assemblies, method of field assembly, workspace requirements, and access for cable connections.
 - 2. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by District.
 - 3. Cabling Administration Drawings.
- C. Wiring diagrams to show typical wiring schematics including the following:
 - 1. Workstation outlets, jacks, and jack assemblies.
 - 2. Patch cords (Category 6 and Fiber Optic). Copper patch panels and blocks.
 - 3. Fiber-optic enclosures.
 - 4. Distribution blocks.
 - 5. Equipment racks.
- D. Submit manufacturers' product data sheets for each component of the voice, data and IP speaker-clock systems. Certify that the data sheets depict the components to be provided by the Contractor to make up the complete system as described in this specification. Submit details of the warranty (including manufacturer warranties) to be provided for the cabling systems, clearly indicating that all components are covered.
- E. Submit samples of the labels to be used for labeling cables, patch panels, termination frames, cabinets and racks.
- F. Submit a testing schedule indicating how each voice, data and IP speaker-clock cabling system component is to be tested. The schedule shall, as a minimum, indicate the testing process from factory testing through to final acceptance testing. The schedule shall list (by part number) testing equipment that will be used and detail each step of each test to be performed. The schedule shall list the criteria that will be applied to each test of each component of the telephone and data cabling systems. The schedule shall include the test results form that will be filled in by the tester as each component is tested.
 - 1. Submit example copy of copper and fiber test reports
- G. Once samples have been submitted, reviewed by the School District Representative and approved they shall be retained. The samples shall be used as the standards by which the quality of work on the project by the Contractor shall be judged. Any installation, which does not meet this Once samples have been submitted, review by the School District Representative and approved, they standard, shall be replaced or reworked as approved by the School District Representative.

1.8 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
 - 1. Submit references for a minimum of twenty similar projects successfully undertaken and completed within the last ten years. As a minimum, provide project name and address, client contact name and telephone number, and construction manager name and telephone number. Provide a brief description of each project indicating types of systems installed, quantities and configurations of outlets, and projected time scales.
- B. Seismic Qualification Certificates: For equipment frames from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions. Base certification on the maximum number of components capable of being mounted in each rack type. Identify components on which certification is based.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.9 AS BUILT DOCUMENTATION

- A. Cable termination numbering, patch panel and fiber enclosure identification shall be coordinated with School District Representative.
- B. The as-built documentation shall consist of prints with the station location numbers (faceplate identification numbers) inserted next to the symbol for the location.
- C. The prints shall also contain the cabling routes taken between the cable tray, conduit and/or J-Hooks and the termination areas.
- D. An additional requirement shall be a wire run list created in Microsoft Excel that contains the specific details of each location and all of the cables that are terminated there. Create separate tabs in the spreadsheet for MDF and each IDF.

1.10 COORDINATION

- A. Coordinate layout and installation of telecommunications equipment with District's Representative.
- B. Meet jointly with telecommunications and LAN equipment suppliers and District to exchange information and agree on details of equipment arrangements and installation interfaces.
 - 1. Record agreements reached in meetings and distribute to other participants.
 - 2. Adjust arrangements and locations of distribution frames and cross-connect and patch panels in equipment rooms and wiring closets to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.

1.11 SYSTEM TESTING

- A. Following voice, data, IP speaker-clock and fiber optic cable installation and termination at both ends, undertake and record tests to ensure that the cabling system will perform satisfactorily in service. In addition to the tests detailed in this specification, the Contractor shall carry out any additional tests that he deems necessary to ensure the satisfactory operation of the telephone, data, and fiber optic cable systems. The costs of these additional tests shall be borne by the Contractor.
- B. Provide the District Representative with the opportunity to witness all testing. On request, the installer shall demonstrate that the test procedure competently identifies the fault conditions being tested for.
- C. Complete the tests identified in all of the voice, data and IP speaker-clock system specifications.
- D. Notify the District Representative fourteen working days before the date of commencement of the cable tests. Provide details, on that advance date, of proposed tests, the test schedule, equipment to be used, its certification and calibration, and the names and qualifications of test personnel.
- E. Personnel shall be competent in and qualified by experience or training for detailed design, installation, and testing of voice, data, and fiber optic cable systems.
- F. Include the cost of obtaining, calibrating, and maintaining test equipment, and the cost of carrying out and recording the tests, including labor costs, in the bid sum.
- G. Ensure that all Test Equipment is in calibration before delivery to site and throughout the testing period. The installer shall be responsible for ensuring that any necessary tests and rework to maintain equipment's calibration status are carried out.
- H. To support the test procedure, create a printed table of every cable in the building with appropriate columns for each test result and comments.
- I. Sign and date each successful series of test results as the tests proceed. As a minimum, each completed page of test results shall be signed and dated once all the tests on that page have been successfully completed and their results recorded.
- J. The test documentation shall be available for inspection by the School District Representative during the installation period and the original documents (not copies or retyped versions) shall be passed to the School District Representative within five working days of completion of tests on cables in each area. The installer shall retain a copy to aid preparation of as-built information.
- K. Failures detected during the testing shall be duly noted on the test results schedule and rectified. On the fault being rectified, this shall also be noted. These notes shall not be deleted or obliterated.
- L. Rectification of all damaged cables shall include replacing damaged cables with new cables in complete runs or remaking poor terminations. In-line cable joints, splices, or distribution points are not acceptable. All damaged cables shall be removed from site.

1.12 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of a RCDD.
 2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
 3. Field Inspector: Currently registered by BICSI as a RCDD to perform the on-site inspection.
 4. Products, services, and materials provided by the Contractor shall be new and of high quality and free of faults and defects.
 5. Provide products, services, and materials as specified in this document. Substitution of products, services, or materials will only be considered if the Contactor follows procedures and requirements specified in Section 01330.
 6. Work shall be done by a qualified CommScope (AMP) NETCONNECT PartnerPro Contractor holding licenses required by legally constituted authorities having jurisdiction over the work. Contractor shall have completed at least twenty (20) projects of equal scope to systems described herein and shall have been engaged in business of supplying and installing specified type of systems for at least 5 years.
 7. Contractor shall warranty all work executed and materials furnished shall be free from defects of material and workmanship for a period of one (1) year from acceptance date of Contract Completion. Immediately upon receipt of written notice from the District, Contractor shall repair or replace at no expense to the District: Any defective material or work which may be discovered before final acceptance or work, or within warranty period; any material or work damaged thereby; and adjacent material or work which may be displaced in repair or replacement.
 8. Examination of or failure to examine work by the District shall not relieve Contractor from these obligations.
 9. If Contractor fails to repair or replace material or work indicated above within 7 days of receiving written notice, the District, with its own personnel or by Contract, may proceed with repair or replacement and assess cost against Contractor, if Contractor does not respond accordingly.
 10. Persons skilled in trade shall install system in accordance with best trade practice. Further, in accordance with all applicable building codes. Contractor and all contractors' employees terminating cable to wiring terminating devices shall be certified by the manufacturer of the wiring device. Copies of certificates shall be provided to the District Representative prior to the start of work.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Equipment frames shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

2.2 BACKBOARDS

- A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels specified in Section 06 "Rough Carpentry."

2.3 SUBSTITUTIONS: Not accepted.

2.4 INTERMEDIATE DISTRIBUTION FRAME (IDF)

- A. Provide wall mounted 66 punch down blocks for multi-pair copper backbone cabling terminations.
 - 1. Quantity to match cable pair count, + 25% spare.
 - 2. Fuse protectors not required.
- B. Equipment Frame
 - 1. Manufacturer: Chatsworth Products, Inc.
 - a. 7' High. Quantity per plans.
 - b. Description: Universal self-support two post 19" wide steel rack for equipment shown on drawings. Equipment rack shall be securely fastened to floor at each corner of each section per details.
 - c. Mounting Hole Pattern: 5/8" - 5/8" - 1/2" C to C, 12-24 thread, two sides.
 - d. Finish: Black baked enamel.
 - e. Maximum port density per cabinet:
 - f. 160 data ports
 - 2. Double-Sided Tray (UPS and/or CPU), provide (2) per IDF:
 - a. Manufacturer: Chatsworth Products, Inc.
 - b. Description: 18-3/4" deep x 5-3/4" high x 19" wide.
 - 3. Wire Managers
 - a. Manufacturer: Chatsworth Products, Inc. / CommScope AMP NETCONNECT
 - b. Description: 1-3/4" high x 19" wide x 2" deep.
 - c. Provide 1U horizontal wire management between each patch panel and piece of rack mounted equipment. Provide (2) spares.
 - 4. Provide vertical wire management at both ends of each rack front and back sides.
 - a. CPI# 30161-703

5. Rack Mount Vertical Power Outlet Strip
 - a. CPI Part #12848-706 with 20 amp power cord, or equal.
 - b. Description: Rack mounting power strip with 6 receptacles on back, front panel with master switch, indicator light, and circuit breaker. Power strip shall be vertically mounted.
 - c. 6' power cord.
- C. Wall Mounted Equipment Cabinet (District approval required for use.) Provide IDF equipment
 1. Manufacturer: Middle Atlantic
 - a. SR-46-28
 2. Description: Wall mounted three compartment equipment cabinet with 5" deep rear panel, 19" deep main panel and lockable front door with tinted window.
 3. Maximum port density per cabinet:
 - a. 140 data ports
 4. Provide separate communications cabinet at IDF locations requiring wall mounted equipment cabinets for CATV, security and any additional telephone feeds.
 - a. Minimum size: 36"Wx24"Hx6"D
 5. Horizontal Power Strip, provide (1) in wall mounted equipment cabinet:
 - a. Power Strips: Comply with UL 1363.
 - b. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - c. Rack mounting.
 - d. Nine, 15-A, 120-V ac, NEMA WD 6, Configuration 5-15R and one always on receptacles. APC# NET9RMBLK.
 - e. LED indicator lights for power and protection status.
 - f. LED indicator lights for reverse polarity and open outlet ground.
 - g. Circuit Breaker and Thermal Fusing: When protection is lost, circuit opens and cannot be reset.
 - h. Cord connected with 15-foot (4.5-m)] line cord.
 - i. Rocker-type on-off switch, illuminated when in on position.
 - j. Peak Single-Impulse Surge Current Rating: 26 kA per phase.
 - k. Protection modes shall be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all three modes shall be not more than 330 V.
 - l. IDF Grounding, provide grounding kit in IDF rack/cabinet for grounding:
 6. Manufacturer: Chatsworth Products, Inc.
 - a. CPI# 40159-008

2.5 IDF EQUIPMENT

A. Fiber Enclosure

1. Provide fiber enclosure.
 - a. 1RU: CommScope AMP NETCONNECT part#: 1435555-1

- b. 4RU: CommScope AMP NETCONNECT part#: 559552-2
 - 2. Duplex SC fiber snap-in adapter panels in quantities required.
 - a. CommScope AMP NETCONNECT part#: 559558-6 (6 Fiber SC)
 - b. CommScope AMP NETCONNECT part#: 559596-5 (12 Fiber SC)
 - c. CommScope AMP NETCONNECT part#: 559523-1 (Blank filler plate)
 - 3. Provide SC/LC MM fiber connectors, MM fiber couplers, fan-out kits and fiber patch cords as necessary to terminate all fibers in the IDF.
- B. Copper Patch Panels
 - 1. Provide Category 6A 24-port unshielded patch panels in quantities as required to terminate Category 6A cables from each outlet. Leave 25% spare capacity for future cable terminations. Provide cable support bars at rear of each panel. All cables shall be secured to bar using Velcro straps.
 - a. 48-Port 2U UTP Patch Panel, CAT6A, Unshielded (with jacks) CommScope AMP NETCONNECT Part#: 2111571-1
 - 2. Data Jacks -- Provide SL Series (AMP-TWIST) Category 6A data jack inserts, black, unshielded (patch panel shall be fully loaded.) Data jacks shall be wired EIA 568B.
 - 3. Provide 24-ports voice patch panels with 25 pair tails for incoming Voice feed termination block in IDF rack to terminate voice cables, Ortronics #OR-808004388.
- C. Uninterruptable Power Supply, provide (1) per IDF:
 - 1. Manufacturer: American Power Conversions (APC)
 - a. APC# SMX2200RMLV2U
 - 1) Provide (1) APC# AP9630 Network Management Card 2
- D. Horizontal Power Strip, provide (2):
 - 1. Power Strips: Comply with UL 1363.
 - 2. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 3. Rack mounting.
 - 4. Nine, 15-A, 120-V ac, NEMA WD 6, Configuration 5-15R and one always on receptacles. APC# NET9RMBLK.
 - 5. LED indicator lights for power and protection status.
 - 6. LED indicator lights for reverse polarity and open outlet ground.
 - 7. Circuit Breaker and Thermal Fusing: When protection is lost, circuit opens and cannot be reset.
 - 8. Cord connected with 15-foot (4.5-m)] line cord.
 - 9. Rocker-type on-off switch, illuminated when in on position.
 - 10. Peak Single-Impulse Surge Current Rating: 26 kA per phase.

11. Protection modes shall be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all three modes shall be not more than 330 V.

E. Patch Cords

1. Fiber, provide quantities as required to connect to active hardware. Coordinate with District.
 - a. [Duplex LC to Duplex SC OM4 MM 50/125 micron XG Fiber
 - 1) CommScope AMP NETCONNECT part#: PAT-LCSC-R40CxxxM (2-meter in length)]
2. Copper, unshielded, provide quantities as required for total count of data drops. Color shall be gray. Patch cords to be installed by District.
 - a. Unshielded, 7' patch cords, 25% of total drop count.
 - 1) CommScope AMP NETCONNECT part# TCPC-6ARUVB-GY07F
 - b. Unshielded, 4' patch cords, 75% of total drop count.
 - 1) CommScope AMP NETCONNECT part# TCPC-6ARUVB-GY04F

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

- A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and housing when so directed by service provider.
Comply with requirements in Section 270528 "Pathways for Communications Systems" for materials and installation requirements for underground pathways.

3.2 INSTALLATION

- A. NO Splicing of Fiber or Copper Cables. All Fiber will be a Home-run from the MDF to the IDF and all Copper will be a Home-run from the IDF to the Data Port.
- B. Comply with NECA 1.
- C. Comply with BICSI TDMM for layout and installation of communications equipment rooms.
- D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
- E. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.
 1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
 2. Record agreements reached in meetings and distribute them to other participants.

3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
 4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.
- F. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.
- G. Cables connecting to equipment racks shall be installed with not less than six feet of slack cable between the equipment rack/terminal block and terminal backboard. The slack cable shall be coiled and supported on the backboard and/or cable tray.
- H. Cables shall be trained, dressed and racked on the plywood backboards. Provide cable, metal support arms and re-enterable type cable support rings not less than 12 inches on center mounted onto the plywood along the entire length of all cables.
- I. No single cable run shall exceed 290 feet.
- J. Provide 36 inches of cable slack at workstation outlets.
- K. Provide cables installed from individual computer/data workstation outlets to respective terminal closet/room equipment rack patch panel. Cables shall be continuous without cutting or splices.
- L. Minimum bending radius of fiber optic cables shall not be less than 12-inches. Maximum pulling tension shall not exceed 25 pounds. In no case shall the manufacturer's recommendations be violated.
- M. The minimum bending radius for copper wire cables shall be 10 times the cable outside diameter. The maximum pulling tension and minimum bending radius shall not violate manufacturer's recommendations.
- N. Cable lengths over 50 feet shall be machine pulled and not hand pulled. Cables shall be pulled in a continuous, smooth operation without jerking or stop-start motion after initiation of pull. Maximum cable pulling speed shall be less than 50 feet per minute. Minimum cable pulling speed shall be greater than 15 feet per minute.
- O. A dynamometer to measure pulling tension shall be used on all cable runs in excess 200 feet or with more than 180 degrees in bends. The actual pulling tension value shall be calculated and recorded for each pull. A written report will be provided to the District.
- P. The portions of cables installed without raceways or cable tray supports shall be installed with "j-hook" cable supports.
1. The "J-hooks" shall provide multi-tiered "treed" "J" shared hooks, with wide flat cable support base (0.5"W minimum) and smooth rounded corners, specifically designed for Category-6 and fiber optic cable support. As manufactured by Erico Inc or substitution of equal or better and approved by the District.
 2. The individual "j-hook" attachment to the building structure shall be "beam clamp", "hanger rod", clevis hanger styles.

3. Install "J-hooks" not more than 36 inches on center along the entire cable length, at each cable change in direction, to insure less than 6 inches of cable sag between adjacent hooks. Secure cables to "J-hooks" with cable tie wraps. "J-hooks" supported cables, bundle cables together with tie wraps.
 4. "Bridle rings" shall not be used to support cables.
 5. Cables shall not rest directly on ceilings, ceiling hangers, lighting fixtures, air ducts, piping, or equipment.
- Q. In each conduit to be used for fiber cable provide four (4) 1-inch Innerduct with "Jack-moon" plugs.
- R. All copper horizontal cables shall be installed in the following manner:
1. Cable raceways shall not be filled greater than the NEC maximum fill for the particular raceway type
 2. Cables shall be installed in continuous lengths from origin to destination (no splices) unless specifically addressed in this document
 3. Cable splices are not allowed.
 4. The cable's minimum bend radius of 4 times the cable diameter and maximum pulling tension of 25 lbs. shall not be exceeded
 5. If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of three-foot intervals – at no point shall cable(s) rest on acoustic ceiling grids or panels
 6. Horizontal distribution cables shall be bundled in groups of not greater than 40 cables (cable bundle quantities in excess of 40 cables may cause deformation of the bottom cables within the bundle)
 7. Cable shall be installed above fire-sprinkler and systems and shall not be attached to the system or any ancillary equipment or hardware
 8. The cabling system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices
 9. Cables shall not be attached to ceiling grid or lighting support wires
 10. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the Contractor prior to final acceptance at no cost to the District
 11. Cables shall be identified by a self-adhesive label in accordance with the District standards.
 12. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate
 13. Unshielded twisted pair cable shall be installed so that there are no bends less than four times the cables outside diameter (4 X cable O.D.) at any point in the run
 14. Pulling tension on 4-pair UTP cables shall not exceed 25-pounds for a single cable or cable bundle

15. Cables shall be dressed and terminated in accordance with the recommendations made in the TIA/EIA-568-B document, manufacturer's recommendations, and/or best industry practices
 16. Pair untwist at the termination shall not exceed 0.25 inch for connecting hardware
 17. Cables shall be neatly bundled and dressed to their respective panels or blocks
 18. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame
 19. The cable jacket shall be maintained as close as possible to the termination point
 20. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties
- S. Provide nylon pull strings with all cable runs, conduit stub ups, conduit sleeves, cable trays, open wiring routes, Innerduct, and spare. Pull strings shall be free from cable bundles in open wiring routes.
- T. Provide Velcro cable management straps on all copper cable bundles, the last 20 feet or upon entry into equipment closet, a maximum of 12" apart, on the rear of the equipment racks and on the patch cords within the vertical cable managers. Straps shall be a maximum of 12" apart.
- U. Provide protective bushings at the ends of all exposed conduits used for the data system cabling. This is to include all conduits installed for any future data cabling requirements.

3.3 HANDLING OF CABLE REELS

- A. Cable ends shall be sealed prior to shipment to prevent moisture entry into cable. Cable ends shall remain sealed at all times including during installation. Where ends seals are removed, reseal cable ends by stripping cable finishes back 2" down to insulation. Then apply four layers of an insulating tape crisscross over the cable end and carry back at least 4" onto cable outer finish. Add a containing cover of two layers of vinyl electrical tape completely over the end seal.
- B. Cable reels shall be shipped with factory applied lagging (protective cover) left in place until removal is absolutely necessary. Store reels of cable on a firm surface, paved, or on planking to prevent settling into soft ground.

3.4 CABLE TERMINATIONS

- A. General
1. Computer/data workstation outlets connecting to ports in patch panels shall be grouped together in the patch panel by outlet, room location and building area location. Each group shall be identified with engraved (etched) nameplates indicating grouping identification and individual port numbers.
 2. Polarity and color coding of cable connections at splices, terminations and outlets shall be consistently maintained throughout the entire electronic network system.
 3. Terminate all cables onto respective outlets and terminals. Terminations shall comply with manufacturer's recommendations.

B. Fiber Optic Terminations

1. Individual fiber optic fibers shall each be terminated with a fiber optic fiber connector. The connector for each fiber shall be "plugged" into separate fiber optic fiber interconnection couplers on the rear of each respective outlet.
2. Each fiber optic termination ferrule shall be inspected, after completion of the termination, visually with a fiber optic inspection microscope and an interferometer, to insure fiber "undercut", "protruding" fiber, over polish and under polish of fiber termination ends does not exist in the finished termination ferrule.
3. Fiber optic cables terminated between two fiber optic patch panels located in separate equipment racks. The fibers shall be paired together for purposes of identification. Each pair of fibers shall be "plugged" into separate, physically adjacent fiber optic fiber interconnection couplers at each patch panel. The horizontal/vertical arrangement of paired patch panel fiber couplers shall match at both ends of the fiber cable.

C. Copper Wire Terminations

1. Unless specifically directed otherwise by the District's Representative, Pin assignment for wiring terminations shall comply with ANSI/EIA/TIA 568B.

3.5 EQUIPMENT RACKS

- A. Install, assemble, mount and connect devices and equipment in the respective equipment racks, bolted securely to the rack frame with stainless steel hardware. "Star" style lock washers shall be provided to insure an electrically continuous ground path between the equipment/devices and rack frames.
- B. Provide blank metal filler panels to close unused equipment "front" mounting space in equipment racks, manufacturer's standard finish color.
- C. Provide a copper wire outlet connector in the respective equipment rack for each remote copper wire computer workstation outlet and copper wire cable shown connected to the respective equipment rack. The copper wire outlet connectors in the equipment racks shall be provided in equipment rack mounted copper wire patch panels.
- D. Terminal racks, equipment locations, patch panels, and cross connects shall be arranged to allow for natural cabling progression, minimize crossing of cables and allow easy access to each system component.
- E. Equipment Rack Anchorage:
- F. Securely anchor floor standing racks to the floor at each corner and the adjacent wall at the top of the rack.
- G. Securely anchor wall-mounted racks to the wall at four corners.
- H. Mounting method shall support the total rack weight including installed equipment, but in no case less than 500 pounds with a 2.0 times safety factor.

3.6 CIRCUIT TERMINAL ROOMS AND CLOSETS

- A. Provide conductor/cable training and racking support distribution rings installed on backboards. Support rings shall be spaced a minimum of 10 inches on center along all cable/conductor routing paths on backboards and within 4 inches of each change in cable/conductor direction. As manufactured by Newton 3042 series, Saunders or equal with District approval.

3.7 SLEEVE AND SLEEVE SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

3.8 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."
- B. Comply with TIA-569-B, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.
- D. A firestop system is comprised of the item or items penetrating the fire rated structure; the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, heat, vapor and pressurized water stream.
- E. All penetrations through fire rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating items i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly firestopped.
- F. Firestop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE), licensed in the state where the work is to be performed. A drawing showing the proposed firestopped system, stamped/embossed by the cognizant PE shall be provided to the District's Technical Representative prior to installing the firestop system.
- G. All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.

3.9 LABELING AND IDENTIFICATION

- A. Fiber optic and copper wire cables shall be identified in each pull box, equipment rack and computer workstation outlet. Identification tags shall include the following information:
 - 1. Installation month and date (i.e. 3/2004, 4/2005, etc.)
 - 2. Conductor size conductor type (i.e. loose tube fiber; (#24 AWG UTP Category 3, 200 pair, telephone/voice etc.).

3. Tag type to match existing site condition.
 4. Label the faceplate at the fiber optic tray to correspond to each cable terminated.
- B. Additional Labeling:
1. Camera – CAM
 2. Projector – AV
 3. Clock Speaker – CLK
 4. Speaker only – SPKR
 5. Wireless AP – WAP
- C. Each cable run shall be permanently labeled at each end with a unique sequential number which corresponds to a similar number provided for each data outlet and punch down point. A printed label shall be placed at each of the following locations:
1. On cable at the rear of the patch panel or termination block, provide self-laminating wrap around label, Brady Label self-laminating 1.2” by 1.5” wrap around label #29689 or equal to match site condition.
 2. On each cable in the j-box behind the faceplate location. Provide self-laminating wrap around label, Brady Label self-laminating 1.2” by 1.5” wrap around label #29689 or equal to match site condition.
 3. On the face plate of the patch panel, provide a ¾” by ¾” label with a letter or number identifying the patch panel designation.
 4. On the face of the faceplate in the label holder window.
- D. Labels shall be preprinted or computer-printed type.
- E. The labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.
1. Label the faceplate at the fiber optic tray to correspond to each cable terminated.
 2. On the face plate of the patch panel, provide a ¾” by ¾” label with a letter or number identifying the patch panel designation.
- F. All label printing will be machine generated using indelible ink ribbons or cartridges. Self-laminating labels will be used on cable jackets, approximately sized to the outside diameter of the cable, and placed within view at the termination point on each end. Outlet labels will be the manufacturer’s label provided with the outlet assembly.
- G. Hand written labels are not permitted. Where cable ID includes room number identification the contractor shall obtain written verification of actual room numbers from school site prior to beginning labeling (numbers on plans do not always match actual room numbers). Cable pulling cross reference lists will not be accepted with final documentation.

- H. Each patch panel port shall be identified with a unique sequential labeling scheme “IDF# / Room# / outlet #”. Port identification labeling pattern shall be consistent throughout the project.
- I. All faceplates shall be identified with permanent printed labels. Labels must not be subject to removal by incidental contact. Contractor shall be responsible for replacing defective labeling for a period of one year from date of final sign-off of project.
- J. All fiber optic and UTP feed cables shall be identified with a permanent, water resistant, printed labels at the fiber shelf. Labeling information shall include closet identifications, quantity of conductors (UTP) or strands of (fiber) and house pair designations (UTP).
- K. Labeling shall follow recommended EIA/TIA standards and as requested by the School District to match site condition. Contractor shall confirm labeling pattern prior to final identification and testing. Labeling for new sites shall identify “IDF# / Room# / outlet #”. All test results shall be identified by the final labeling scheme.
- L. All fiber optic cables and/or Innerduct shall be tagged with orange fiber optic warning tags in every manhole and/or pull box. Fiber warning tags shall also be placed at each end of the cable in the termination closets in clear view. A minimum of (3) tags are required at each end. Fiber warning tags shall be placed on fiber optic cable and/or Innerduct routed through open ceiling environments at increments no less than 10 feet apart.

3.10 RECORD DRAWINGS

- A. The installation contractor will be provided with two sets of drawings at the start of the project. One set will be designated for the central location to document all as-built information as it occurs throughout the project. The central set will be maintained by the Contractor’s Foreman on a daily basis, and will be available to the Technical representative upon request during the course of the project. Anticipated variations from the building drawings may be for such things as cable routing and actual outlet placement. No variations will be allowed to the planned termination positions of horizontal and backbone cables, and grounding conductors unless approved in writing by the District. Contractor shall also redraw, with AutoCAD version 2007 or newer, the site and floor plans showing all fiber, copper, racks, and information outlets as well as the labeling scheme for all items. These CAD drawings shall be on 8-1/2” x 11” sheets of paper and disk, and be turned over to the District with the O&M manuals.
- B. The Contractor shall provide the central drawing set to the District at the conclusion of the project. The marked up drawing set will accurately depict the as-built status of the system including termination locations, cable routing, and all administration labeling for the cable system. In addition, a narrative will be provided that describes any areas of difficulty encountered during the installation that could potentially cause problems to the telecommunications system.

3.11 FIELD QUALITY CONTROL

- A. Manufacturer’s Field Services: Provide services of a duly factory authorized service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.

- B. Inspection: Make observations to verify that units and controls are properly labeled, and interconnecting wires and terminal are identified. Provide a list of final tap settings of paging speaker line matching transformers.
- C. Testing:
 - 1. Provide all instruments for testing and demonstrating in the presence of the District's inspector that the system is operating as stated in the factory data sheets. Check all circuits and wiring to verify they are free of shorts and grounds. Perform all tests stated in each separate system specification.
 - 2. Rectify deficiencies indicated by tests and completely re-test work affected by such deficiencies at contractor's expense. Verify by the system test that the total system meets the specifications and complies with applicable standards.
 - 3. The District reserves the right to make independent tests of all equipment furnished to determine whether or not the equipment complies with the requirements specified herein and to accept or reject and or all of the equipment on the basis of the results thereby obtained.

3.12 CLEANING AND PROTECTION

- A. The contractor shall thoroughly clean all equipment and materials. All exposed parts of the equipment, cabinets, and other equipment shall be left in a clean condition, unblemished and free of all dirt, dust, smudges, spots, fingerprints, etc. The contractor shall remove all debris and rubbish occasioned by the electronic systems work from the site. The contractor shall thoroughly clean all buildings of any dirt, debris, rubbish, marks, etc., caused by the performance of this work.

3.13 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 District.
- B. The contractor shall maintain a competent service organization and shall, if requested, submit a service maintenance agreement to the District after the end of the guarantee period.
- C. A typewritten notice shall be posted at the equipment rack which shall indicate the firm, address and telephone number to call when service is necessary. The notice shall be mounted in a neatly finished metal frame with a clear plastic window and securely attached to the inside of the door.
- D. Manufacturer Warranty
 - 1. The contractor shall facilitate a 25-year system performance warranty between the manufacturer and the District. An extended component warranty shall be provided which warrants functionality of all cabling and connectivity components used in the system for 25 years from the date of acceptance. The performance warranty shall warrant the installed horizontal copper and both the horizontal and the backbone optical fiber portions of the cabling system. Copper and fiber optic links shall be warranted to the link or channel performance as defined in ANSI/EIA-568-C.

2. Upon completion of the project, the customer's technical representative will perform a final inspection of the installed cabling system with the contractor's project foreman. The final inspection will be performed to validate that all horizontal and backbone cables were installed as defined in the drawing package, and that the installation meets the aesthetic expectations of the customer.
3. Upon receipt of the test documentation, the customer reserves the right to perform spot testing of a representative sample of the cabling system to validate test results provided in the test document. Customer testing will use the same method employed by the contractor, and minor variations shall be allowed to account for differences in test equipment and test variability. If significant discrepancies are found, the contractor will be notified for resolution.
4. During the three week period between final inspection and delivery of the test and as-built documentation, the customer will activate the cabling system. The customer will validate operation of the cabling system during this period.
5. Completion of the installation, in-progress and final inspections, receipt of the test, receipt of the as-built documentation, and successful performance of the system for a two week period will constitute acceptance of the system.

E. Special Warranty

6. The contractor shall warrant the cabling system against defects in workmanship for a period of two years from the date of system acceptance. The warranty shall cover all labor and materials necessary to correct a failed portion of the system and to demonstrate performance within the original installation specifications after repairs are accomplished. All warranty repairs shall be done within fourteen days from being notified in writing by the District. This warranty shall be provided at no additional cost to the District.

END OF SECTION 271100

SECTION 271300

COMMUNICATIONS BACKBONE CABLING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. All applicable portions of Division 26, Division 27, and Division 28 shall apply to this section as though written herein completely.

1.02 SUMMARY

- A. Section Includes:
 - 1. UTP Cable.
 - 2. Optical Fiber Cable.
 - 3. Cable connecting hardware.
 - 4. Cable identification products.

1.03 SCOPE OF WORK

- A. The work described by this part includes the furnishing of all materials, equipment, supplies, labor and the performing of all operations necessary for the installation of complete and operating systems.
- B. All conduits, outlet boxes, back boxes, junction boxes, terminal cabinets, backboards, wiring, cables, equipment, devices, etc. unless existing, shall be furnished and installed complete under this section. Conduit and junction box sizes shall be determined by the Installing Electrical Contractor for the particular wire and cable fills required for the systems installed. (Conduit sizes shall comply with the California Electrical Code). The entire responsibility of the system, including the installation, operation, function, testing and maintenance for one (1) year after final acceptance under this section shall be the responsibility of the installing electronic contractor.
- C. The Installing Electronic Systems Contractor shall furnish and install all equipment, cables, devices, and other materials even though not specifically mentioned herein, which are necessary for the proper integration of the system so that the system shall perform the functions listed herein in compliance with all specified requirements.
- D. Contractor shall provide District with all packing slips and receipts for all equipment over \$500. This equipment requires a G-number for District tracking. Contractor is responsible for coordinating with CM, PM and site MSF for delivery of all equipment.

1.04 DEFINITIONS

- A. Backbone: A facility (e.g., pathway, cable, or conductors) between telecommunications rooms or floor distribution terminals, the entrance facilities, and the equipment rooms within or between buildings.
- B. BDF: Building Distribution Frame (same location as MDF)
- C. BICSI: Building Industry Consulting Service International.
- D. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.
- E. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- F. EMI: Electromagnetic interference.
- G. Horizontal Cabling: Cabling between and including the telecommunications outlet/connector and the horizontal cross-connect. Also the cabling between and including the building automation system outlet or the first mechanical terminations on the horizontal connection point and the horizontal cross-connect.
- H. IDC: Insulation displacement connector.
- I. IDF: Intermediate Distribution Frame
- J. LAN: Local area network.
- K. MDF: Main Distribution Frame
- L. MTR: Main Telephone Room
- M. RCDD: Registered Communications Distribution Designer.
- N. RMC: Rigid metallic conduit.
- O. UTP: Un-shielded twisted pair cable.

1.05 BACKBONE CABLING DESCRIPTION

- A. Backbone cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.
- B. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.

1.06 PERFORMANCE REQUIREMENTS

- A. General Performance: Backbone cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

1.07 APPLICABLE STANDARDS

- A. The equipment shall be U.L. listed labeled, and approved for the application shown in the contract documents.
- B. The complete system material, equipment, testing, installation and workmanship shall comply with requirements of:
 - 1. This Technical Specification and Associated Drawings.
 - 2. ANSI/TIA 568-C.0 Generic Telecommunications Cabling for Customer Premises
 - 3. ANSI/TIA 568-C.1 Commercial Building Telecommunications Cabling Standard
 - 4. ANSI/TIA 568-C.2 Balanced Twisted-Pair Telecommunications Cabling and Components Standards
 - 5. ANSI/TIA 568-C.3 Optical Fiber Cabling Components Standard
 - 6. EIA/TIA-TSB-36 Technical Systems Bulletin, Additional Cable Specifications for Unshielded Twisted-Pair Cables-November, 1991 and all applicable revisions and addendums.
 - 7. TIA/EIA-TSB-40 Telecommunications Systems Bulletin, Additional Transmission Specifications for Unshielded-Pair Connecting Hardware – January, 1994 and all applicable revisions and addendums.
 - 8. TIA/EIA-TSB-75 Telecommunications System Bulletin, Additional Transmission Specifications for Unshielded Twisted-Pair consolidation points and cabling – January, 1997 and all applicable revisions and addendums.
 - 9. ANSI/EIA/TIA-569 Commercial Building Standard for Telecommunications Pathways and Spaces – October 1990 and all applicable revisions and addendums.
 - 10. ANSI/EIA/TIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings – February 1993 and all applicable revisions and addendums.
 - 11. J-STD-607-A Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications – October 2002 and all applicable revisions and addendums.
 - 12. Building Industries Consulting Services, International (BICSI) Telecommunications Distribution Methods Manual (TDMM)-2000 and all applicable revisions and addendums.
 - 13. TIA TSB62-23 Telecommunications Systems Bulletin, Measurement of the Non-linear coefficient of single-mode fibers – January 2003 and all applicable revisions and or addendums to these documents.
 - 14. CEC (Current Edition, including all applicable revisions, addendums and errata's.)

1.08 QUALIFICATIONS

- A. The installing Electronic Systems Contractor must be a CommScope (AMP) NETCONNECT certified contractor. Provide a copy of Contractor's CommScope AMP NETCONNECT certification with bid package. The Installing Electronic Contractor shall be an authorized CommScope AMP NETCONNECT PartnerPro business partner and shall provide 25 years extended product warranty and application assurance on this installation.
- B. The supplier of the equipment shall be an authorized AMP ND & I distributor and service facility.

- C. The Installing Electronic Systems Contractor shall hold a valid State of California C-7 license for all low voltage installations and a State of California C-10 License for any related high-voltage applications and shall have completed at least twenty projects including five projects with Grossmont Union High School District of equal scope, shall have been in business of furnishing and installing communication systems of this type for at least ten years, and capable of being bonded to assure the District of performance and satisfactory service during the guarantee period.
- D. The Installing Electronic Systems 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 Contractor shall maintain a spare set of all major parts for the system at all times. All circuit boards, amplifiers and control sub systems shall be 100% backed up with stock at contractor's shop.
- E. Extend material and Performance Warranties.
 - 1. The contractor shall facilitate and extend to the District all manufacturers' warranties for all products installed. Extended system (performance) and component warranties shall be provided which warrants functionality of all existing and new components (cable, connecting hardware and patch cords) used in the system for a minimum of (25) twenty-five years from the date of acceptance. Each component of the system shall be covered for defects in materials and workmanship. Copper links shall be warranted against the link performance minimum expected results defined in the TIA/EIA SP-2840A, Annex E. Fiber optic links shall be warranted against the link and segment performance minimum expected results defined in the TIA/EIA SP-2840A, Annex H. All fiber and copper cabling, termination components, and ancillary devices shall be of one manufacturer to insure no disputes can arise between different manufacturers' if performance problems arise. Installers shall be factory trained technicians with a factory trained supervisor overseeing the project.
 - 2. Warranty scope includes, but is not limited to, network cables and terminations, network workstation plug-in outlets, and patch panel plug-in outlets, cable splices and connectors.
 - 3. Repair or replace the defective material at the project premise, to comply with the performance standards outlined in the contract documents during the warranty period.
 - 4. All newly installed fiber optic cabling and any existing fiber optic cabling which was disconnected/reconnect during the course of this project shall require complete link test in accordance with the testing requirements specified elsewhere in this document, and require an CommScope AMP NETCONNECT 25-Year EWP warranty.
 - 5. In addition to the manufacturer warranties, the Contractor shall provide their own 2-year warranty covering all aspects of the project to include workmanship.
 - 6. Upon successful completion of the installation and subsequent inspection, the District's Project Manager shall be provided with a numbered certificate, from the manufacturing company, registering the installation.
 - 7. All conditions for obtaining the manufacturers' warranty shall be the sole responsibility of the contractor.
- F. The structured cabling system shall be an CommScope AMP NETCONNECT end-to-end solution. No equal. All equipment must be approved by District (Technology and Information Services).

1.09 ACTION SUBMITTALS

- A. Provide three (3) full-size installation samples of the voice, data and IP speaker-clock system outlet. The sample shall include, as a minimum, the faceplate, two data and two voice system connectors (each terminated with a 12" length of distribution cabling) two blanking plates, and back boxes.
- B. Shop Drawings:
 - 1. Include dimensioned plan and elevation views of telecommunications equipment rooms, labeling each individual component. Show equipment rack assemblies, method of field assembly, workspace requirements, and access for cable connections.
 - 2. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by District.
 - 3. Cabling Administration Drawings.
- C. Wiring diagrams to show typical wiring schematics including the following:
 - 1. Workstation outlets, jacks, and jack assemblies.
 - 2. Patch cords (Category 6 and Fiber Optic). Copper patch panels and blocks.
 - 3. Fiber-optic enclosures.
 - 4. Distribution blocks.
 - 5. Equipment racks.
- D. Submit manufacturers' product data sheets for each component of the voice, data and IP speaker-clock systems. Certify that the data sheets depict the components to be provided by the Contractor to make up the complete system as described in this specification. Submit details of the warranty (including manufacturer warranties) to be provided for the cabling systems, clearly indicating that all components are covered.
- E. Submit samples of the labels to be used for labeling cables, patch panels, termination frames, and faceplates for the telephone and data systems.
- F. Submit a testing schedule indicating how each voice, data and IP speaker-clock cabling system component is to be tested. The schedule shall, as a minimum, indicate the testing process from factory testing through to final acceptance testing. The schedule shall list (by part number) testing equipment that will be used and detail each step of each test to be performed. The schedule shall list the criteria that will be applied to each test of each component of the telephone and data cabling systems. The schedule shall include the test results form that will be filled in by the tester as each component is tested.
 - 1. Submit example copy of copper and fiber test reports
- G. Once samples have been submitted, reviewed by the School District Representative and approved they shall be retained. The samples shall be used as the standards by which the quality of work on the project by the Contractor shall be judged. Any installation, which does not meet this standard, shall be replaced or reworked as approved by the School District Representative.

1.010 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1. Submit references for a minimum of twenty similar projects successfully undertaken and completed within the last ten years. As a minimum, provide project name and address, client contact name and telephone number, and construction manager name and telephone number. Provide a brief description of each project indicating types of systems installed, quantities and configurations of outlets, and projected time scales.

1.011 AS BUILT DOCUMENTATION

- A. Faceplate labeling, cable termination numbering, patch panel and fiber enclosure identification shall be coordinated with School District Representative.
- B. The as-built documentation shall consist of prints with the station location numbers (faceplate identification numbers) inserted next to the symbol for the location.
- C. The prints shall also contain the cabling routes taken between the cable tray, conduit and/or J-Hooks and the workstation areas.
- D. An additional requirement shall be a wire run list created in Microsoft Excel that contains the specific details of each location and all of the cables that are terminated there. Create separate tabs in the spreadsheet for MDF and each IDF.

1.012 COORDINATION

- A. Coordinate layout and installation of voice, data and IP speaker-clock cabling with District's Representative.
- B. Meet jointly with telecommunications and LAN equipment suppliers and District to exchange information and agree on details of equipment arrangements and installation interfaces.
 1. Record agreements reached in meetings and distribute to other participants.
 2. Adjust arrangements and locations of distribution frames and cross-connect and patch panels in equipment rooms and wiring closets to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
- C. Provide products, services, and materials as specified in this document. Substitution of products, services, or materials will only be considered if the Contactor follows procedures and requirements specified in Division 1.

1.013 SYSTEM TESTING

- A. Following voice, data, IP speaker-clock and fiber optic cable installation and termination at both ends, undertake and record tests to ensure that the cabling system will perform satisfactorily in service. In addition to the tests detailed in this specification, the Contractor shall carry out any additional tests that he deems necessary to ensure the satisfactory operation of the telephone, data, and fiber optic cable systems. The costs of these additional tests shall be borne by the Contractor.
- B. Provide the School District Representative with the opportunity to witness all testing. On request, the installer shall demonstrate that the test procedure competently identifies the fault conditions being tested for.

- C. Complete the tests identified in all of the voice, data and IP speaker-clock system specifications.
- D. Notify the District Representative fourteen working days before the date of commencement of the cable tests. Provide details, on that advance date, of proposed tests, the test schedule, equipment to be used, its certification and calibration, and the names and qualifications of test personnel.
- E. Personnel shall be competent in and qualified by experience or training for detailed design, installation, and testing of voice, data, and fiber optic cable systems.
- F. Include the cost of obtaining, calibrating, and maintaining test equipment, and the cost of carrying out and recording the tests, including labor costs, in the bid sum.
- G. Ensure that all Test Equipment is in calibration before delivery to site and throughout the testing period. The installer shall be responsible for ensuring that any necessary tests and rework to maintain equipment's calibration status are carried out.
- H. To support the test procedure, create a printed table of every cable in the building with appropriate columns for each test result and comments.
- I. Sign and date each successful series of test results as the tests proceed. As a minimum, each completed page of test results shall be signed and dated once all the tests on that page have been successfully completed and their results recorded.
- J. The test documentation shall be available for inspection by the School District Representative during the installation period and the original documents (not copies or retyped versions) shall be passed to the School District Representative within five working days of completion of tests on cables in each area. The installer shall retain a copy to aid preparation of as-built information.
- K. Failures detected during the testing shall be duly noted on the test results schedule and rectified. On the fault being rectified, this shall also be noted. These notes shall not be deleted or obliterated.
- L. Rectification of all damaged cables shall include replacing damaged cables with new cables in complete runs or remaking poor terminations. In-line cable joints, splices, or distribution points are not acceptable. All damaged cables shall be removed from site.

1.014 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 - 1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of a RCDD.
 - 2. Installation Supervision: Installation shall be under the direct supervision of a Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
 - 3. Field Inspector: Currently registered by BICSI as a RCDD to perform the on-site inspection.
 - 4. Products, services, and materials provided by the Contractor shall be new and of high quality and free of faults and defects.

5. Provide products, services, and materials as specified in this document. Substitution of products, services, or materials will only be considered if the Contractor follows procedures and requirements specified in Division 01.
6. Work shall be done by a qualified CommScope AMP NETCONNECT PartnerPro Contractor holding licenses required by legally constituted authorities having jurisdiction over the work. Contractor shall have completed at least ten (10) projects of equal scope to systems described herein and shall have been engaged in business of supplying and installing specified type of systems for at least 5 years.
7. Contractor shall warranty all work executed and materials furnished shall be free from defects of material and workmanship for a period of two (2) years from acceptance date of Contract Completion. Immediately upon receipt of written notice from the District, Contractor shall repair or replace at no expense to the District: Any defective material or work which may be discovered before final acceptance or work, or within warranty period; any material or work damaged thereby; and adjacent material or work which may be displaced in repair or replacement.
8. Examination of or failure to examine work by the District shall not relieve Contractor from these obligations.
9. If Contractor fails to repair or replace material or work indicated above within 7 days of receiving written notice, the District, with its own personnel or by Contract, may proceed with repair or replacement and assess cost against Contractor, if Contractor does not respond accordingly.
10. Persons skilled in trade shall install system in accordance with best trade practice. Further, in accordance with all applicable building codes. Contractor and all contractors' employees terminating cable to wiring terminating devices shall be certified by the manufacturer of the wiring device. Copies of certificates shall be provided to the District Representative prior to the start of work.

PART 2 - PRODUCTS

2.1 FIBER OPTIC BACKBONE CABLE

- A. Provide XG OM4 Indoor/Outdoor, Loose tube, 50/125mu Multimode Non plenum Fiber Optic cable from MDF to IDF cabinet. Provide 20' service loop at both ends. Provide 6' long fiber optic patch cables at each MDF and IDF. Changes need to be approved by District ETS. Single mode fiber optic cable is not acceptable. Fiber strand count to match Construction Drawings.
 1. 6F Multimode, XG OM4 50/125 Riser, Indoor/Outdoor Loose Tube, CommScope AMP NETCONNECT part#: 6-1553342-5
 2. 12F Multimode, XG OM4 50/125 Riser, Indoor/Outdoor Loose Tube, CommScope AMP NETCONNECT part#: 6-1553346-5
 3. 24F Multimode, XG OM4 50/125 Riser, Indoor/Outdoor Loose Tube, CommScope AMP NETCONNECT part#: 6-1553348-5
- B. Fiber Optic Cable shall be one continuous length without any splicing. All fibers in a multi-fiber cable shall be fully operational within the performance characteristics prior to and after installation. The use of spare fibers in the cable to compensate for defective fibers is not permitted. Defective cable shall be removed and replaced with fully functional cable at no additional cost to the contract.

- C. Fiber Optic Cable shall be UL listed, complying with CEC and ETL verified to meet or exceed specified requirement.
- D. Provide "SC" type termination connector at each end of all fiber optic cables. SC connectors shall be ceramic aluminum oxide 2.5mm ferrule, multi-cure ultra violet or heat cured epoxy bonded to match cable fiber. Insertion loss of each mated connector shall be less than 0.3 dB. Provide dust cover cap for each connector. Connectors shall be CommScope AMP NETCONNECT part#: 6588291-2.
- E. All fiber cable shall be rated for the space that it is installed. Cables installed in underground conduit shall be loose tube gel filled with rated jacket.
- F. Label all fiber optic cable with permanent orange tags. Labeling shall follow the guidelines of ANSI/TIA/EIA – 606-A.

2.2 UTP CABLE

- B. 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. CommScope AMP NETCONNECT.
 2. Berk-Tek; a Nexans company.
 3. Superior Essex Inc.
- C. Description: 100-ohm, 25-pair Indoor/Outdoor UTP, formed into 25-pair binder groups covered with a thermoplastic jacket.
 1. Comply with ICEA S-90-661 for mechanical properties.
 2. Comply with TIA/EIA-568-B.1 for performance specifications.
 3. Comply with TIA/EIA-568-B.2, Category 5e.
 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types: Communications, type CMR.

2.3 UTP CABLE HARDWARE

- 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. CommScope AMP NETCONNECT.
 2. Ortronics Network Infrastructure Solutions by Legrand.
 3. Leviton Manufacturing Co., Inc.
- B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.
- C. Connecting Blocks: 66-style IDC for Category 5e. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.

- D. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.
 - 1. Number of Terminals per Field: One for each conductor in assigned cables.

PART 3 - EXECUTION

3.01 CABLE INSTALLATION

- A. Fiber splices are not allowed.
- B. Cables connecting to equipment racks shall be installed with not less than six feet of slack cable between the equipment rack/terminal block and terminal backboard. The slack cable shall be coiled and supported on the backboard and/or cable tray.
- C. Cables shall be trained, dressed and racked on the plywood backboards. Provide cable, metal support arms and re-enterable type cable support rings not less than 12 inches on center mounted onto the plywood along the entire length of all cables.
- D. Minimum bending radius of fiber optic cables shall not be less than 12-inches. Maximum pulling tension shall not exceed 25 pounds. In no case shall the manufacturer's recommendations be violated.
- E. The minimum bending radius for copper wire cables shall be 10 times the cable outside diameter. The maximum pulling tension and minimum bending radius shall not violate manufacturer's recommendations.
- F. Cable lengths over 50 feet shall be machine pulled and not hand pulled. Cables shall be pulled in a continuous, smooth operation without jerking or stop-start motion after initiation of pull. Maximum cable pulling speed shall be less than 50 feet per minute. Minimum cable pulling speed shall be greater than 15 feet per minute.
- G. A dynamometer to measure pulling tension shall be used on all cable runs in excess 200 feet or with more than 180 degrees in bends. The actual pulling tension value shall be calculated and recorded for each pull. A written report will be provided to the District.
- H. The portions of cables installed without raceways or cable tray supports shall be installed with "j-hood" cable supports.
 - 1. The "J-hooks" shall provide multi-tiered "treed" "J" shared hooks, with wide flat cable support base (0.5"W minimum) and smooth rounded corners, specifically designed for Category-6 and fiber optic cable support. As manufactured by Erico Inc or substitution of equal or better and approved by the District.
 - 2. The individual "J-hook" attachment to the building structure shall be "beam clamp", "hanger rod", clevis hanger styles.
 - 3. Install "J-hooks" not more than 36 inches on center along the entire cable length, at each cable change in direction, to insure less than 6 inches of cable sag between

adjacent hooks. Secure cables to "J-hooks" with cable tie wraps. "J-hooks" supported cables, bundle cables together with tie wraps.

4. "Bridle rings" shall not be used to support cables.
5. Cables shall not rest directly on ceilings, ceiling hangers, lighting fixtures, air ducts, piping, or equipment.
- I. In each 4" conduit to be used for fiber cable provide four (4) 1-inch Innerduct with "Jack-moon" plugs.
- J. Provide nylon pull strings with all cable runs, conduit stub ups, conduit sleeves, cable trays, open wiring routes, Innerduct, and spare. Pull strings shall be free from cable bundles in open wiring routes.
- K. Provide Velcro cable management straps on all copper cable bundles, the last 20 feet or upon entry into equipment closet, a maximum of 12" apart, on the rear of the equipment racks and on the patch cords within the vertical cable managers. Straps shall be a maximum of 12" apart.
- L. Provide protective bushings at the ends of all exposed conduits used for the data system cabling. This is to include all conduits installed for any future data cabling requirements.

3.02 HANDLING OF CABLE REELS

- A. Cable ends shall be sealed prior to shipment to prevent moisture entry into cable. Cable ends shall remain sealed at all times including during installation. Where ends seals are removed, reseal cable ends by stripping cable finishes back 2" down to insulation. Then apply four layers of an insulating tape criss-cross over the cable end and carry back at least 4" onto cable outer finish. Add a containing cover of two layers of vinyl electrical tape completely over the end seal.
- B. Cable reels shall be shipped with factory applied lagging (protective cover) left in place until removal is absolutely necessary. Store reels of cable on a firm surface, paved, or on planking to prevent settling into soft ground.

3.03 CABLE TERMINATIONS

- A. General
 1. Polarity and color coding of cable connections at splices, terminations and outlets shall be consistently maintained throughout the entire electronic network system.
 2. Terminate all cables onto respective outlets and terminals. Terminations shall comply with manufacturer's recommendations.
- B. Fiber Optic Terminations
 1. Individual fiber optic fibers shall each be terminated with a fiber optic fiber connector. The connector for each fiber shall be "plugged" into separate fiber optic fiber interconnection couplers on the rear of each respective outlet.
 2. Each fiber optic termination ferrule shall be inspected, after completion of the termination, visually with a fiber optic inspection microscope and an interferometer, to insure fiber

“undercut”, “protruding” fiber, over polish and under polish of fiber termination ends does not exist in the finished termination ferrule.

3. Fiber optic cables terminated between two fiber optic patch panels located in separate equipment racks. The fibers shall be paired together for purposes of identification. Each pair of fibers shall be "plugged" into separate, physically adjacent fiber optic fiber interconnection couplers at each patch panel. The horizontal/vertical arrangement of paired patch panel fiber couplers shall match at both ends of the fiber cable.

C. Copper Wire Terminations

1. Unless specifically directed otherwise by the District's Representative, Pin assignment for wiring terminations shall comply with ANSI/EIA/TIA 568B.

3.04 CIRCUIT TERMINAL ROOMS AND CLOSETS

- A. Provide conductor/cable training and racking support distribution rings installed on backboards. Support rings shall be spaced a minimum of 10 inches on center along all cable/conductor routing paths on backboards and within 4 inches of each change in cable/conductor direction. As manufactured by Newton 3042 series, Saunders or equal with District approval.

3.05 LABELING AND IDENTIFICATION

- A. Fiber optic and copper wire cables shall be identified in each pull box, equipment rack and computer workstation outlet. Identification tags shall include the following information:
 1. Installation month and date (i.e. 3/2011, 4/2012, etc.)
 2. Conductor size conductor type (i.e. loose tube fiber; (#24 AWG UTP Category 3, 200 pair, telephone/voice etc.).
 3. Tag type to match existing site condition.
 4. Label the faceplate at the fiber optic tray to correspond to each cable terminated.
- B. The labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.
- C. All label printing will be machine generated using indelible ink ribbons or cartridges. Self-laminating labels will be used on cable jackets, approximately sized to the outside diameter of the cable, and placed within view at the termination point on each end. Outlet labels will be the manufacturer's label provided with the outlet assembly.
- D. Hand written labels are not permitted. Where cable ID includes room number identification the contractor shall obtain written verification of actual room numbers from school site prior to beginning labeling (numbers on plans do not always match actual room numbers). Cable pulling cross reference lists will not be accepted with final documentation.
- E. Each patch panel port shall be identified with a unique sequential labeling scheme – “IDF# / Room# / outlet #”. Port identification labeling pattern shall be consistent throughout the project.

- F. All faceplates shall be identified with permanent printed labels. Labels must not be subject to removal by incidental contact. Contractor shall be responsible for replacing defective labeling for a period of one year from date of final sign-off of project.
- G. All fiber optic and UTP feed cables shall be identified with a permanent, water resistant, printed labels at the fiber shelf. Labeling information shall include closet identifications, quantity of conductors (UTP) or strands of (fiber) and house pair designations (UTP).
- H. Labeling shall follow recommended EIA/TIA standards and as requested by the School District to match site condition. Contractor shall confirm labeling pattern prior to final identification and testing. Labeling for new sites shall identify "IDF# / Room# / outlet #". All test results shall be identified by the final labeling scheme.
- I. All fiber optic cables and/or innerduct shall be tagged with orange fiber optic warning tags in every manhole and/or pull box. Fiber warning tags shall also be placed at each end of the cable in the termination closets in clear view. A minimum of (3) tags are required at each end. Fiber warning tags shall be placed on fiber optic cable and/or innerduct routed through open ceiling environments at increments no less than 10 feet apart.

3.06 CABLE SYSTEM TESTING

- A. All cables and termination hardware shall be 100% tested for defects in installation to verify cable performance under installed conditions. All conductors of each installed cable shall be verified useable by the contractor prior to system acceptance. Any defect in the cable system installation including but not limited to cable, connectors, feed-through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.
- B. Each copper cable shall be tested for continuity on all pairs and/or conductors. Twisted-pair data cables shall be tested for the all of the above requirements, plus tests that indicate installed cable performance. All category 6 cables shall be tested to ensure the category 6 standard performance to 500Mhz is complied with. All tests shall be printed out in hard copy in the quantity called out in the general specifications for O&M and turn over documents as well as one disc copy for the Districts use. All test reports shall be delivered to the District prior to project close out. Data cables shall be tested using a (Fluke – DSP 4000 series or equivalent) cable analyzer.
- C. Continuity
 - 1. Each pair of each installed cable shall be tested using a "green light" test set that shows opens, shorts, polarity and pair-reversals. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicted 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 prior to final acceptance.
- D. Length
 - 1. Each installed cable shall be tested for installed length using a 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 identification number and circuit or pair number. For multi-pair cables, the longest pair length shall be recorded as the length for the cable.

2. Near End Cross-Talk (NEXT)
3. Attenuation
4. Ambient Noise
5. Attenuation to Cross-Talk Ratio (ACR)
6. Test results shall be automatically evaluated by the equipment, using the most up-to-date criteria from the 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.

E. Fiber

1. All fiber terminations shall be visually inspected with a minimum 200X microscope to ensure that no surface imperfections exist after final polishing. In addition, each fiber strand shall be tested for attenuation with an optical power meter and light source as well as an OTDR. Cable length shall be verified using and OTDR.

F. Attenuation

1. Horizontal distribution multimode optical fiber attenuation shall be measured at either 850 nanometers (nm) or 1300 nm using and LED light source and power meter. Backbone multimode fiber shall be tested at both 850 nm and 1300 nm in one direction. Test set-up and performance shall be conducted in accordance with ANSI/EIA/TIA-526-14 Standard, Method B. One 2-meter patch cord shall be used for the test reference and two 2-meter patch cords shall be used for the actual test. This test method uses a one jumper reference, two jumper test to estimate the actual link loss of the installed cables plus the loss of two connectors. This measurement is consistent with the loss which network equipment will see under normal installation and use. Test evaluation for the panel to panel (backbone) or panel to outlet (horizontal) shall be based on the values set forth in the ANSI/TIA 568-C.3, Optical Fiber Link Performance Testing.
2. Where concatenated links are installed to complete a circuit between devices, the Contractor shall test each link from end to end to ensure the performance of the system. After the link performance test has been successfully completed, each link shall be concatenated and tested. The test method shall be the same used for the test described above. The evaluation criteria shall be established between the District and the Contractor prior to the start of the test.
3. Test evaluation for the panel to panel (backbone) shall be based on the values set forth in the ANSI/TIA 568-C.3, Optical Fiber Link Performance Testing.

G. Length

1. Each cable shall be tested with an Optical Time Domain Reflectometer (OTDR) to verify installed cable length. The OTDR measurements for length shall be performed in accordance with EIA/TIA-455-60. These tests shall be employed on all cables after installation and in addition where one or more of the following conditions exist.
2. OTDR and power meter testing is specifically requested by the District.
3. Each strand shall be tested on all outside plant and tight-buffered cables.

4. A representative strand of each fiber cable shall be tested to verify length if the estimated cable length is within 10% of the maximum length specified, respective to cable function, in the ANSI/TIA 568-C Standard.

H. Test Documentation

1. Test documentation shall be provided in a three-ring binder(s) within three weeks after the completion of the 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 major heading tabs, Horizontal and Backbone. Each major heading shall be further sectioned by test type. Within the horizontal and backbone sections, scanner test results (Category 3, 4, or 5), fiber optic attenuation test results, OTDR traces, and green light test results shall be segregated by tab. Test data within each section shall be presented in the sequence listed in the administration records. The test equipment by name, manufacturer, model number and last calibration date will also be provided at the end of the document. 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. The test document shall detail the test method used and the specific settings of the equipment during the test.
2. Scanner tests shall be printed on 8-1/2" x 11". Hand written test results (attenuation results and green light results) shall be documented on an Excel spreadsheet. OTDR test results shall be printed or attached and copied on 8-1/2" x 11" paper for inclusion in the test documentation binder. Provide spreadsheet on a CD
3. 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 collated in the binder.

3.07 RECORD DRAWINGS

- A. The installation contractor will be provided with two sets of drawings at the start of the project. One set will be designated for the central location to document all as-built information as it occurs throughout the project. The central set will be maintained by the Contractor's Foreman on a daily basis, and will be available to the Technical representative upon request during the course of the project. Anticipated variations from the building drawings may be for such things as cable routing and actual outlet placement. No variations will be allowed to the planned termination positions of horizontal and backbone cables, and grounding conductors unless approved in writing by the District. Contractor shall also redraw, with AutoCAD version 2004 or newer, the site and floor plans showing all fiber, copper, racks, and information outlets as well as the labeling scheme for all items. These CAD drawings shall be on 8-1/2" x 11" sheets of paper and disk, and be turned over to the District with the O&M manuals.
- B. The Contractor shall provide the central drawing set to the District at the conclusion of the project. The marked up drawing set will accurately depict the as-built status of the system including termination locations, cable routing, and all administration labeling for the cable system. In addition, a narrative will be provided that describes any areas of difficulty encountered during the installation that could potentially cause problems to the telecommunications system.

3.08 FIRESTOP SYSTEMS

- A. A firestop system is comprised of the item or items penetrating the fire rated structure; the opening in the structure and the materials and assembly of the materials used to seal the penetrated

structure. Firestop systems comprise an effective block for fire, heat, vapor and pressurized water stream.

- B. All penetrations through fire rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating items i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly firestopped.
- C. Firestop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE, licensed (actual or reciprocal) in the state where the work is to be performed. A drawing showing the proposed firestopped system, stamped/embossed by the cognizant PE shall be provided to the District's Technical Representative prior to installing the firestop system.
- D. All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.

3.09 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Provide services of a duly factory authorized service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.
- B. Inspection: Make observations to verify that units and controls are properly labeled, and interconnecting wires and terminal are identified. Provide a list of final tap settings of paging speaker line matching transformers.
- C. Testing:
 - 1. Provide all instruments for testing and demonstrating in the presence of the District's inspector that the system is operating as stated in the factory data sheets. Check all circuits and wiring to verify they are free of shorts and grounds. Perform all tests stated in each separate system specification.
 - 2. Rectify deficiencies indicated by tests and completely re-test work affected by such deficiencies at contractor's expense. Verify by the system test that the total system meets the specifications and complies with applicable standards.
 - 3. The District reserves the right to make independent tests of all equipment furnished to determine whether or not the equipment complies with the requirements specified herein and to accept or reject and or all of the equipment on the basis of the results thereby obtained.

3.010 CLEANING AND PROTECTION

- A. The contractor shall thoroughly clean all equipment and materials. All exposed parts of the equipment, cabinets, and other equipment shall be left in a clean condition, unblemished and free of all dirt, dust, smudges, spots, fingerprints, etc. The contractor shall remove all debris and rubbish occasioned by the electronic systems work from the site. The contractor shall thoroughly clean all buildings of any dirt, debris, rubbish, marks, etc., caused by the performance of this work.

3.011 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 District.
- B. The contractor shall maintain a competent service organization and shall, if requested, submit a service maintenance agreement to the District after the end of the guarantee period.
- C. A typewritten notice shall be posted at the equipment rack which shall indicate the firm, address and telephone number to call when service is necessary. The notice shall be mounted in a neatly finished metal frame with a clear plastic window and securely attached to the inside of the door.
- D. Manufacturer Warranty
 - 1. The contractor shall facilitate a 25-year system performance warranty between the manufacturer and the District. An extended component warranty shall be provided which warrants functionality of all cabling and connectivity components used in the system for 25 years from the date of acceptance. The performance warranty shall warrant the installed horizontal copper and both the horizontal and the backbone optical fiber portions of the cabling system. Copper and fiber optic links shall be warranted to the link or channel performance as defined in ANSI/EIA-568-C.
 - 2. Upon completion of the project, the customer's technical representative will perform a final inspection of the installed cabling system with the contractor's project foreman. The final inspection will be performed to validate that all horizontal and backbone cables were installed as defined in the drawing package, and that the installation meets the aesthetic expectations of the customer.
 - 3. Upon receipt of the test documentation, the customer reserves the right to perform spot testing of a representative sample of the cabling system to validate test results provided in the test document. Customer testing will use the same method employed by the contractor, and minor variations shall be allowed to account for differences in test equipment and test variability. If significant discrepancies are found, the contractor will be notified for resolution.
 - 4. During the three week period between final inspection and delivery of the test and as-built documentation, the customer will activate the cabling system. The customer will validate operation of the cabling system during this period.
 - 5. Completion of the installation, in-progress and final inspections, receipt of the test, receipt of the as-built documentation, and successful performance of the system for a two week period will constitute acceptance of the system.
- E. Special Warranty
 - 1. The contractor shall warrant the cabling system against defects in workmanship for a period of one year from the date of system acceptance. The warranty shall cover all labor and materials necessary to correct a failed portion of the system and to demonstrate performance within the original installation specifications after repairs are accomplished. All warranty repairs shall be done within fourteen days from being notified in writing by the District. This warranty shall be provided at no additional cost to the District.

END OF SECTION 271300

SECTION 27 15 00

COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. All applicable portions of Division 26, Division 27, and Division 28 shall apply to this section as though written herein completely.

1.02 SUMMARY

- A. Section Includes:
 - 1. UTP Cable.
 - 2. Patch Cables.
 - 3. Voice Data Outlets
 - 4. Wireless Systems.

1.03 SCOPE OF WORK

- A. The work under this section shall consist of all cabling, outlets, cabinets, patch panels, and associated material for a complete voice, data system as shown on the plans and as specified herein.
- B. All conduits, outlet boxes, back boxes, junction boxes, terminal cabinets, backboards, wiring, cables, equipment, devices, etc. unless existing, shall be furnished and installed complete under this section. Conduit and junction box sizes shall be determined by the Installing Electrical Contractor for the particular wire and cable fills required for the systems installed. (Conduit sizes shall comply with the California Electrical Code). The entire responsibility of the system, including the installation, operation, function, testing and maintenance for one (1) year after final acceptance under this section shall be the responsibility of the installing electronic contractor.
- C. The Installing Electronic Systems Contractor shall furnish and install all equipment, cables, devices, and other materials even though not specifically mentioned herein, which are necessary for the proper integration of the system so that the system shall perform the functions listed herein in compliance with all specified requirements.
- D. Contractor shall provide District with all packing slips, and receipts for all equipment over \$500. This equipment requires a G-number for District tracking. Contractor is responsible for coordinating with CM, PM and site MSF for delivery of all equipment.

1.04 DEFINITIONS

- A. Backbone: A facility (e.g., pathway, cable, or conductors) between telecommunications rooms or floor distribution terminals, the entrance facilities, and the equipment rooms within or between buildings.
- B. BDF: Building Distribution Frame (same location as MDF)
- C. BICSI: Building Industry Consulting Service International.
- D. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.

- E. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- F. EMI: Electromagnetic interference.
- G. Horizontal Cabling: Cabling between and including the telecommunications outlet/connector and the horizontal cross-connect. Also the cabling between and including the building automation system outlet or the first mechanical terminations on the horizontal connection point and the horizontal cross-connect.
- H. IDC: Insulation displacement connector.
- I. IDF: Intermediate Distribution Frame
- J. LAN: Local area network.
- K. MDF: Main Distribution Frame
- L. MTR: Main Telephone Room
- M. RCDD: Registered Communications Distribution Designer.
- N. RMC: Rigid metallic conduit.
- O. UTP: Un-shielded twisted pair cable.

1.05 APPLICABLE STANDARDS

- A. The equipment shall be U.L. listed and labeled, and approved for the application shown in the contract documents.
- B. The complete system material, equipment, testing, installation and workmanship shall comply with requirements of:
 - 1. This Technical Specification and Associated Drawings.
 - 2. ANSI/TIA 568-C.0 Generic Telecommunications Cabling for Customer Premises
 - 3. ANSI/TIA 568-C.1 Commercial Building Telecommunications Cabling Standard
 - 4. ANSI/TIA 568-C.2 Balanced Twisted-Pair Telecommunications Cabling and Components Standards
 - 5. ANSI/TIA 568-C.3 Optical Fiber Cabling Components Standard
 - 6. EIA/TIA-TSB-36 Technical Systems Bulletin, Additional Cable Specifications for Unshielded Twisted-Pair Cables-November, 1991 and all applicable revisions and addendums.
 - 7. TIA/EIA-TSB-40 Telecommunications Systems Bulletin, Additional Transmission Specifications for Unshielded-Pair Connecting Hardware – January, 1994 and all applicable revisions and addendums.
 - 8. TIA/EIA-TSB-75 Telecommunications System Bulletin, Additional Transmission Specifications for Unshielded Twisted-Pair consolidation points and cabling – January, 1997 and all applicable revisions and addendums.
 - 9. ANSI/EIA/TIA-569 Commercial Building Standard for Telecommunications Pathways and Spaces – October 1990 and all applicable revisions and addendums.
 - 10. ANSI/EIA/TIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings – February 1993 and all applicable revisions and addendums.
 - 11. J-STD-607-A Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications – October 2002 and all applicable revisions and addendums.
 - 12. Building Industries Consulting Services, International (BICSI) Telecommunications Distribution Methods Manual (TDMM)-2000 and all applicable revisions and addendums.

13. TIA TSB62-23 Telecommunications Systems Bulletin, Measurement of the Non-linear coefficient of single-mode fibers – January 2003 and all applicable revisions and or addendums to these documents.
14. CEC (Current Edition, including all applicable revisions, addendums and errata's.)

1.06 QUALIFICATIONS

- A. The installing Electronic Systems Contractor must be a CommScope (AMP) NETCONNECT PartnerPro certified contractor. Provide a copy of Contractor's CommScope AMP NETCONNECT certification with bid package. The Installing Electronic Contractor shall be an authorized CommScope AMP NETCONNECT PartnerPro business partner and shall provide 25 years extended product warranty and application assurance on this installation.
- B. The supplier of the equipment shall be an authorized CommScope AMP NETCONNECT distributor and service facility.
- C. The Installing Electronic Systems Contractor shall hold a valid State of California C-7 license for all low voltage installations and a State of California C-10 License for any related high-voltage applications and shall have completed at least twenty projects including five projects with Grossmont Union High School District of equal scope, shall have been in business of furnishing and installing communication systems of this type for at least ten years, and capable of being bonded to assure the District of performance and satisfactory service during the guarantee period.
- D. The Installing Electronic Systems 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 Contractor shall maintain a spare set of all major parts for the system at all times. All circuit boards, amplifiers and control sub systems shall be 100% backed up with stock at contractor's shop.
- E. Extend material and Performance Warranties.
 1. The contractor shall facilitate and extend to the District all manufacturers' warranties for all products installed. Extended system (performance) and component warranties shall be provided which warrants functionality of all existing and new components (cable, connecting hardware and patch cords) used in the system for a minimum of (25) twenty-five years from the date of acceptance. Each component of the system shall be covered for defects in materials and workmanship. Copper links shall be warranted against the link performance minimum expected results defined in the TIA/EIA SP-2840A, Annex E. Fiber optic links shall be warranted against the link and segment performance minimum expected results defined in the TIA/EIA SP-2840A, Annex H. All fiber and copper cabling, termination components, and ancillary devices shall be of one manufacturer to insure no disputes can arise between different manufacturers' if performance problems arise. Installers shall be factory trained technicians with a factory trained supervisor overseeing the project.
 2. Warranty scope includes, but is not limited to, network cables and terminations, network workstation plug-in outlets, and patch panel plug-in outlets, cable splices and connectors.
 3. Repair or replace the defective material at the project premise, to comply with the performance standards outlined in the contract documents during the warranty period.
 4. All newly installed fiber optic cabling and any existing fiber optic cabling which was disconnected/reconnect during the course of this project shall require complete link test in accordance with the testing requirements specified elsewhere in this document, and require an AMP 25-Year EWP warranty.
 5. In addition to the manufacturer warranties, the Contractor shall provide their own 2-year warranty covering all aspects of the project to include workmanship.

6. Upon successful completion of the installation and subsequent inspection, the District's Project Manager shall be provided with a numbered certificate, from the manufacturing company, registering the installation.
 7. All conditions for obtaining the manufacturers' warranty shall be the sole responsibility of the contractor.
- F. The structured cabling system shall be a CommScope AMP NETCONNECT end-to-end solution. No equal. All equipment must be approved by District (Technology and Information Services).

1.07 ACTION SUBMITTALS

- A. Provide three (3) full-size installation samples of the voice, data and IP speaker-clock system outlet. The sample shall include, as a minimum, the faceplate, two data and two voice system connectors (each terminated with a 12" length of distribution cabling) two blanking plates, and back boxes.
- B. Shop Drawings:
 1. Include dimensioned plan and elevation views of telecommunications equipment rooms, labeling each individual component. Show equipment rack assemblies, method of field assembly, workspace requirements, and access for cable connections.
 2. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by District.
 3. Cabling Administration Drawings.
- C. Wiring diagrams to show typical wiring schematics including the following:
 1. Workstation outlets, jacks, and jack assemblies.
 2. Patch cords (Category 6 and Fiber Optic). Copper patch panels and blocks.
 3. Fiber-optic enclosures.
 4. Distribution blocks.
 5. Equipment racks.
- D. Submit manufacturers' product data sheets for each component of the voice, data and IP speaker-clock systems. Certify that the data sheets depict the components to be provided by the Contractor to make up the complete system as described in this specification. Submit details of the warranty (including manufacturer warranties) to be provided for the cabling systems, clearly indicating that all components are covered.
- E. Submit samples of the labels to be used for labeling cables, patch panels, termination frames, and faceplates for the telephone and data systems.
- F. Submit a testing schedule indicating how each voice, data and IP speaker-clock cabling system component is to be tested. The schedule shall, as a minimum, indicate the testing process from factory testing through to final acceptance testing. The schedule shall list (by part number) testing equipment that will be used and detail each step of each test to be performed. The schedule shall list the criteria that will be applied to each test of each component of the telephone and data cabling systems. The schedule shall include the test results form that will be filled in by the tester as each component is tested.
 1. Example copy of copper and fiber test reports.
- G. Once samples have been submitted, reviewed by the School District Representative and approved they shall be retained. The samples shall be used as the standards by which the quality of work on the project by the Contractor shall be judged. Any installation, which does not meet this standard, shall be replaced or reworked as approved by the School District Representative.

1.08 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1. Submit references for a minimum of twenty similar projects successfully undertaken and completed within the last ten years. As a minimum, provide project name and address, client contact name and telephone number, and construction manager name and telephone number. Provide a brief description of each project indicating types of systems installed, quantities and configurations of outlets, and projected time scales.

1.09 AS-BUILT DOCUMENTATION

- A. Faceplate labeling, cable termination numbering, patch panel and fiber enclosure identification shall be coordinated with School District Representative.
- B. The as-built documentation shall consist of prints with the station location numbers (faceplate identification numbers) inserted next to the symbol for the location.
- C. The prints shall also contain the cabling routes taken between the cable tray, conduit and/or J-Hooks and the workstation areas.
- D. An additional requirement shall be a wire run list created in Microsoft Excel that contains the specific details of each location and all of the cables that are terminated there. Create separate tabs in the spreadsheet for MDF and each IDF.

1.10 COORDINATION

- A. Coordinate layout and installation of voice, data and IP speaker-clock cabling with District's Representative.
- B. Meet jointly with telecommunications and LAN equipment suppliers and District to exchange information and agree on details of equipment arrangements and installation interfaces.
 1. Record agreements reached in meetings and distribute to other participants.
 2. Adjust arrangements and locations of distribution frames and cross-connect and patch panels in equipment rooms and wiring closets to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
- C. Provide products, services, and materials as specified in this document. Substitution of products, services, or materials will only be considered if the Contactor follows procedures and requirements specified in Division 1.

1.11 SYSTEM TESTING

- A. Following voice, data, IP speaker-clock and fiber optic cable installation and termination at both ends, undertake and record tests to ensure that the cabling system will perform satisfactorily in service. In addition to the tests detailed in this specification, the Contractor shall carry out any additional tests that he deems necessary to ensure the satisfactory operation of the telephone, data, and fiber optic cable systems. The costs of these additional tests shall be borne by the Contractor.
- B. Provide the School District Representative with the opportunity to witness all testing. On request, the installer shall demonstrate that the test procedure competently identifies the fault conditions being tested for.
- C. Complete the tests identified in all of the voice, data and IP speaker-clock system specifications.
- D. Notify the District Representative fourteen working days before the date of commencement of the cable tests. Provide details, on that advance date, of proposed tests, the test schedule, equipment to be used, its certification and calibration, and the names and qualifications of test personnel.

- E. Personnel shall be competent in and qualified by experience or training for detailed design, installation, and testing of voice, data, and fiber optic cable systems.
- F. Include the cost of obtaining, calibrating, and maintaining test equipment, and the cost of carrying out and recording the tests, including labor costs, in the bid sum.
- G. Ensure that all Test Equipment is in calibration before delivery to site and throughout the testing period. The installer shall be responsible for ensuring that any necessary tests and rework to maintain equipment's calibration status are carried out.
- H. To support the test procedure, create a printed table of every cable in the building with appropriate columns for each test result and comments.
- I. Sign and date each successful series of test results as the tests proceed. As a minimum, each completed page of test results shall be signed and dated once all the tests on that page have been successfully completed and their results recorded.
- J. The test documentation shall be available for inspection by the School District Representative during the installation period and the original documents (not copies or retyped versions) shall be passed to the School District Representative within five working days of completion of tests on cables in each area. The installer shall retain a copy to aid preparation of as-built information.
- K. Failures detected during the testing shall be duly noted on the test results schedule and rectified. On the fault being rectified, this shall also be noted. These notes shall not be deleted or obliterated.
- L. Rectification of all damaged cables shall include replacing damaged cables with new cables in complete runs or remaking poor terminations. In-line cable joints, splices, or distribution points are not acceptable. All damaged cables shall be removed from site.

1.12 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 - 1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of a RCDD.
 - 2. Installation Supervision: Installation shall be under the direct supervision of a Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
 - 3. Field Inspector: Currently registered by BICSI as a RCDD to perform the on-site inspection.
 - 4. Products, services, and materials provided by the Contractor shall be new and of high quality and free of faults and defects.
 - 5. Provide products, services, and materials as specified in this document. Substitution of products, services, or materials will only be considered if the Contractor follows procedures and requirements specified in Division 01.
 - 6. Work shall be done by a qualified CommScope (AMP) NETCONNECT PartnerPro Contractor holding licenses required by legally constituted authorities having jurisdiction over the work. Contractor shall have completed at least ten (10) projects of equal scope to systems described herein and shall have been engaged in business of supplying and installing specified type of systems for at least 5 years.
 - 7. Contractor shall warranty all work executed and materials furnished shall be free from defects of material and workmanship for a period of two (2) years from acceptance date of Contract Completion. Immediately upon receipt of written notice from the District, Contractor shall repair or replace at no expense to the District: Any defective material or work which may be discovered before final acceptance or work, or within warranty period;

- any material or work damaged thereby; and adjacent material or work which may be displaced in repair or replacement.
8. Examination of or failure to examine work by the District shall not relieve Contractor from these obligations.
 9. If Contractor fails to repair or replace material or work indicated above within 7 days of receiving written notice, the District, with its own personnel or by Contract, may proceed with repair or replacement and assess cost against Contractor, if Contractor does not respond accordingly.
 10. Persons skilled in trade shall install system in accordance with best trade practice. Further, in accordance with all applicable building codes. Contractor and all contractors' employees terminating cable to wiring terminating devices shall be certified by the manufacturer of the wiring device. Copies of certificates shall be provided to the District Representative prior to the start of work.

PART 2 - PRODUCTS

2.01 COPPER WIRE CABLE (TWISTED PAIRS)

- A. Provide enhanced category 6A (4 pair) non plenum, unshielded, blue color cable from each system jack indicated on the drawings to each building IDF or MDF patch panel.
- B. Enhanced Category 6A unshielded, blue color cable shall be copper wire, individually insulated and color coded, with an overall non-conductive jacket,
 1. CAT 6A U/UTP, CMR, CommScope (AMP) NETCONNECT part# TE640R-BL02
- C. All cable installed underground shall be rated for that use.
- D. Provide ten foot service loop at the MDF/IDF location and three foot service loop at outlet location for each cable.
- E. Provide enhanced category 6A cable for Data, Voice, LCD projector, IP camera, wireless data access point, IP speaker and combination IP clock/speaker system.

2.02 PORTABLE CATEGORY 6A COPPER WIRE PATCH CABLE ASSEMBLY

- A. Provide Category 6A patch cable assembly, unshielded, with pre-molded boot for all system jacks (for data, VOIP, LCD projector, IP camera, Wireless data access point, IP clock, IP speaker and combination IP clock/speaker), interconnecting electronic network equipment to electronic network outlets, interconnecting patch panel outlet patch locations with each other, interconnecting patch outlet to electronic equipment, and outlets location as indicated on drawings.
 1. All patch cables assembly shall be in compliance with manufacturer's "Link" Warranty requirements.
 2. b. Patch cables assembly shall be factory assembled with factory terminated plugs at each end. Field terminated patch cables assembly shall not be permitted. Terminated plug shall incorporate integral bending radius limiting molded "boots" and strain relief. Patch cables assembly shall be rated for "heavy duty" service.
 3. c. Patch cables assembly shall comply with the same cable communication performance requirement as the cables and outlets.
- B. Provide following type portable Category 6A copper wire patch cable assembly.

1. Gray 8' Category 6A unshielded patch cable assembly for data and VOIP, CommScope AMP NETCONNECT part# TCPC-6ARUVB-GY08F (work station location). Provide 85% of total work station patch cables assembly.
2. Gray 15' Category 6A unshielded patch cord assembly for data and VOIP, CommScope AMP NETCONNECT part# TCPC-6ARUVB-GY15F (work station location). Provide 15% of total work station patch cables assembly.
3. Blue 7' Category 6A unshielded patch cable assembly for IP clocks, IP speakers, and combination IP clock/speakers (at device location), CommScope AMP NETCONNECT part# TCPC-6ARUVB-BL07F. Provide 20% spare cables assembly.
4. White 6' Category 6A unshielded patch cable assembly for LCD projector and IP camera, CommScope AMP NETCONNECT part# TCPC-6ARUVB-WT06F. Provide 50% spare cables assembly.

2.03 VOICE DATA OUTLETS

A. Outlets

1. Faceplates: Manufacturer -- CommScope AMP NETCONNECT. (This is a necessary item, that is only available from the listed source, or it is required to match existing Campus standards, and no other product shall be furnished.) Coordinate faceplates and outlets with Division 26 electrical sections and with existing outlets. ('x' denotes color.)
 - a. 2 Port, straight, single-gang, integrated labeling, Commscope AMP NETCONNECT part#: 2111009-x.
 - b. 3 Port, straight, single-gang, integrated labeling, Commscope AMP NETCONNECT part#: 2111010-x.
 - c. 4 Port, straight, single-gang, integrated labeling, Commscope AMP NETCONNECT part#: 2111011-x.
2. Data Jacks -- Provide SL Series (AMP-TWIST) Category 6A data jack inserts, black, unshielded (patch panel shall be fully loaded.) Data jacks shall be wired EIA 568B.
 - a. SL Series AMP-TWIST 6A Modular Jack, unshielded, CommScope AMP NETCONNECT part# 1933476-2.
 - b. SL Series AMP-TWIST Blank Insert, CommScope AMP NETCONNECT part#: 1116412.
3. Data Jack Color: data jacks shall be color coordinated as follows:
 - a. Voice/Data: Coordinate with Division 26 electrical sections.
 - b. IP Camera: Red
 - c. LCD Projector: Yellow
 - d. IP Speaker: Gray
 - e. Wireless AP: White
 - f. Point of Sale: Orange
 - g. Single Port Voice Only: Green

2.04 SURFACE MOUNT DATA OUTLETS

A. Device boxes:

1. Manufacturer: CommScope AMP NETCONNECT. (This is a necessary item, that is only available from the listed source, or it is required to match existing Campus standards, and

no other product shall be furnished.) Coordinate faceplates and outlets with Division 26 electrical sections and with existing outlets. ('x' denotes color.)

- a. 2-Port Surface Mount Module with SL Series CAT 6A data jacks, CommScope AMP NETCONNECT part#; 1933668-x.

2.05 WIRELESS SYSTEMS

- A. Contractor shall provide mounting and data for wireless access as follows: All wireless equipment will be provided by the District, unless noted here or on the plans.
 - 1. For In-wall mount: Provide a deep 2-gang box with single mud ring mounted between 8-feet and 10-feet high or as shown on the plans. Deep 2-gang box must be clear of obstructions in all directions a minimum of 12".
 - a. Provide 2 Category 6A drop from IDF.
 - b. Provide 2 Port Category 6A 4-Pair Modular Receptacles
 - c. Provide face plate
 - 2. For T-bar Ceiling mount below 10-feet: Provide flush deep 2-gang supported box with single mud ring mounted face down in the ceiling tile. Support in accordance with CBC requirements for equipment under 40 lbs.
 - a. Provide 2 Category 6A drops from IDF.
 - b. Provide 2 Port Category 6A 4-Pair Modular Receptacle
 - c. Provide face plate
- B. Contractor shall provide 2 wireless access point mounting locations per classroom located in opposite corners.
- C. Contractor shall provide 1 mounting location per non-classroom within 400 sq. ft. of another wireless access point mounting location.
- D. Wireless Equipment not listed here to be provided by GUHSD ETS.

PART 3 - EXECUTION

3.01 CABLE INSTALLATION

- A. Cables connecting to equipment racks shall be installed with not less than six feet of slack cable between the equipment rack/terminal block and terminal backboard. The slack cable shall be coiled and supported on the backboard and/or cable tray.
- B. Cables shall be trained, dressed and racked on the plywood backboards. Provide cable, metal support arms and re-enterable type cable support rings not less than 12 inches on center mounted onto the plywood along the entire length of all cables.
- C. No single cable run shall exceed 290 feet from patch panel to device without written direction from the District IS personnel.
- D. Provide 36 inches of cable slack at workstation outlets.
- E. Provide cables installed from individual computer/data workstation outlets to respective terminal closet/room equipment rack patch panel. Cables shall be continuous without cutting or splices.
- F. Minimum bending radius of fiber optic cables shall not be less than 12-inches. Maximum pulling tension shall not exceed 25 pounds. In no case shall the manufacturer's recommendations be violated.

- G. The minimum bending radius for copper wire cables shall be 10 times the cable outside diameter. The maximum pulling tension and minimum bending radius shall not violate manufacturer's recommendations.
- H. Cable lengths over 50 feet shall be machine pulled and not hand pulled. Cables shall be pulled in a continuous, smooth operation without jerking or stop-start motion after initiation of pull. Maximum cable pulling speed shall be less than 50 feet per minute. Minimum cable pulling speed shall be greater than 15 feet per minute.
- I. A dynamometer to measure pulling tension shall be used on all cable runs in excess 200 feet or with more than 180 degrees in bends. The actual pulling tension value shall be calculated and recorded for each pull. A written report will be provided to the District.
- J. The portions of cables installed without raceways or cable tray supports shall be installed with "j-hood" cable supports.
 - 1. The "J-hooks" shall provide multi-tiered "treed" "J" shared hooks, with wide flat cable support base (0.5"W minimum) and smooth rounded corners, specifically designed for Category-6 and fiber optic cable support. As manufactured by Erico Inc. or substitution of equal or better and approved by the District.
 - 2. The individual "J-hook" attachment to the building structure shall be "beam clamp", "hanger rod", clevis hanger styles.
 - 3.
 - 4. Install "J-hooks" not more than 36 inches on center along the entire cable length, at each cable change in direction, to insure less than 6 inches of cable sag between adjacent hooks. Secure cables to "J-hooks" with cable tie wraps. "J-hooks" supported cables, bundle cables together with tie wraps.
 - 5. "Bridle rings" shall not be used to support cables.
 - 6. Cables shall not rest directly on ceilings, ceiling hangers, lighting fixtures, air ducts, piping, or equipment.
- K. All copper horizontal cables shall be installed in the following manner:
 - 1. Cable raceways shall not be filled greater than the CEC maximum fill for the particular raceway type.
 - 2. Cables shall be installed in continuous lengths from origin to destination (no splices) unless specifically addressed in this document.
 - 3. Cable splices are not allowed.
 - 4. The cable's minimum bend radius of 4 times the cable diameter and maximum pulling tension of 25 lbs. shall not be exceeded.
 - 5. If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of four-foot intervals – at no point shall cable(s) rest on acoustic ceiling grids or panels.
 - 6. Horizontal distribution cables shall be bundled in groups of not greater than 40 cables (cable bundle quantities in excess of 40 cables may cause deformation of the bottom cables within the bundle).
 - 7. Cable shall be installed above fire-sprinkler and systems and shall not be attached to the system or any ancillary equipment or hardware.
 - 8. The cabling system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
 - 9. Cables shall not be attached to ceiling grid or lighting support wires.
 - 10. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the Contractor prior to final acceptance at no cost to the District.

11. Cables shall be identified by a self-adhesive label in accordance with the District standards.
 12. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate.
 13. Unshielded twisted pair cable shall be installed so that there are no bends less than four times the cables outside diameter (4 X cable O.D.) at any point in the run.
 14. Pulling tension on 4-pair UTP cables shall not exceed 25-pounds for a single cable or cable bundle.
 15. Cables shall be dressed and terminated in accordance with the recommendations made in the TIA/EIA-568-B document, manufacturer's recommendations, and/or best industry practices.
 16. Pair untwist at the termination shall not exceed 0.25 inch for connecting hardware.
 17. Cables shall be neatly bundled and dressed to their respective panels or blocks.
 18. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.
 19. The cable jacket shall be maintained as close as possible to the termination point.
 20. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties.
- L. Provide nylon pull strings with all cable runs, conduit stub ups, conduit sleeves, cable trays, open wiring routes, Innerduct, and spare. Pull strings shall be free from cable bundles in open wiring routes.
 - M. Provide Velcro cable management straps on all copper cable bundles, the last 20 feet or upon entry into equipment closet, a maximum of 12" apart, on the rear of the equipment racks and on the patch cords within the vertical cable managers. Straps shall be a maximum of 12" apart.
 - N. Provide protective bushings at the ends of all exposed conduits used for the data system cabling. This is to include all conduits installed for any future data cabling requirements.

3.02 HANDLING OF CABLE REELS

- A. Cable ends shall be sealed prior to shipment to prevent moisture entry into cable. Cable ends shall remain sealed at all times including during installation. Where ends seals are removed, reseal cable ends by stripping cable finishes back 2" down to insulation. Then apply four layers of an insulating tape crisscross over the cable end and carry back at least 4" onto cable outer finish. Add a containing cover of two layers of vinyl electrical tape completely over the end seal.
- B. Cable reels shall be shipped with factory applied lagging (protective cover) left in place until removal is absolutely necessary. Store reels of cable on a firm surface, paved, or on planking to prevent settling into soft ground.

3.03 CABLE TERMINATIONS

- A. General
 1. Computer/data workstation outlets connecting to ports in patch panels shall be grouped together in the patch panel by outlet, room location and building area location. Each group shall be identified with engraved (etched) nameplates indicating grouping identification and individual port numbers.
 2. Polarity and color coding of cable connections at splices, terminations and outlets shall be consistently maintained throughout the entire electronic network system.
 3. Terminate all cables onto respective outlets and terminals. Terminations shall comply with manufacturer's recommendations.
- B. Copper Wire Terminations

1. Unless specifically directed otherwise by the District's Representative, Pin assignment for wiring terminations shall comply with ANSI/EIA/TIA 568B.

3.04 CIRCUIT TERMINAL ROOMS AND CLOSETS

- A. Provide conductor/cable training and racking support distribution rings installed on backboards. Support rings shall be spaced a minimum of 10 inches on center along all cable/conductor routing paths on backboards and within 4 inches of each change in cable/conductor direction. As manufactured by Newton 3042 series, Saunders or equal with District approval.

3.05 LABELING AND IDENTIFICATION

- A. Fiber optic and copper wire cables shall be identified in each pull box, equipment rack and computer workstation outlet. Identification tags shall include the following information:
 1. Installation month and date (i.e. 3/2011, 4/2012, etc.)
 2. Conductor size conductor type (i.e. loose tube fiber; (#24 AWG UTP Category 3, 200 pair, telephone/voice etc.).
 3. Tag type to match existing site condition.
 4. Label the faceplate at the fiber optic tray to correspond to each cable terminated.
- B. Additional Labeling:
 1. Camera – CAM
 2. Projector – AV
 3. Clock Speaker – CLK
 4. Speaker only – SPKR
 5. Wireless AP – WAP
- C. Each cable run shall be permanently labeled at each end with a unique sequential number which corresponds to a similar number provided for each data outlet and punch down point. A printed label shall be placed at each of the following locations:
 1. On cable at the rear of the patch panel or termination block, provide self-laminating wrap around label, Brady Label self-laminating 1.2" by 1.5" wrap around label #29689 or equal to match site condition.
 2. On each cable in the j-box behind the faceplate location. Provide self-laminating wrap around label, Brady Label self-laminating 1.2" by 1.5" wrap around label #29689 or equal to match site condition.
 3. On the faceplate of the patch panel, provide a ¾" by ¾" label with a letter or number identifying the patch panel designation.
 4. On the face of the faceplate in the label holder window.
- D. The labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.
- E. All label printing will be machine generated using indelible ink ribbons or cartridges. Self-laminating labels will be used on cable jackets, approximately sized to the outside diameter of the cable, and placed within view at the termination point on each end. Outlet labels will be the manufacturer's label provided with the outlet assembly.
- F. Hand written labels are not permitted. Where cable ID includes room number identification the contractor shall obtain written verification of actual room numbers from school site prior to

beginning labeling (numbers on plans do not always match actual room numbers). Cable pulling cross reference lists will not be accepted with final documentation.

- G. Each patch panel port shall be identified with a unique sequential labeling scheme. Port identification labeling pattern shall be consistent throughout the project.
- H. All faceplates shall be identified with permanent printed labels. Labels must not be subject to removal by incidental contact. Contractor shall be responsible for replacing defective labeling for a period of one year from date of final sign-off of project.
- I. Labeling shall follow recommended EIA/TIA standards and as requested by the School District to match site condition. Contractor shall confirm labeling pattern prior to final identification and testing. Labeling for new sites shall identify “IDF# / Room# / outlet #”. All test results shall be identified by the final labeling scheme.

3.06 CABLE SYSTEM TESTING

- A. All cables and termination hardware shall be 100% tested for defects in installation to verify cable performance under installed conditions. All conductors of each installed cable shall be verified useable by the contractor prior to system acceptance. Any defect in the cable system installation including but not limited to cable, connectors, feed-through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.
- B. Each copper cable shall be tested for continuity on all pairs and/or conductors. Twisted-pair data cables shall be tested for the all of the above requirements, plus tests that indicate installed cable performance. All category 6 cables shall be tested to ensure the category 6 standard performance to 500Mhz is complied with. All tests shall be printed out in hard copy in the quantity called out in the general specifications for O&M and turn over documents as well as one disc copy for the Districts use. All test reports shall be delivered to the District prior to project close out. Data cables shall be tested using a (Fluke – DSP 4000 series or equivalent) cable analyzer.
- C. Continuity
 - 1. Each pair of each installed cable shall be tested using a “green light” test set that shows opens, shorts, polarity and pair-reversals. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicted 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 prior to final acceptance.
- D. Length
 - 1. Each installed cable shall be tested for installed length using a 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 identification number and circuit or pair number. For multi-pair cables, the longest pair length shall be recorded as the length for the cable.
 - 2. Near End Cross-Talk (NEXT)
 - 3. Attenuation
 - 4. Ambient Noise
 - 5. Attenuation to Cross-Talk Ratio (ACR)
 - 6. Test results shall be automatically evaluated by the equipment, using the most up-to-date criteria from the 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.

E. Test Documentation

1. Test documentation shall be provided in a three-ring binder(s) within three weeks after the completion of the 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 major heading tabs, Horizontal and Backbone. Each major heading shall be further sectioned by test type. Within the horizontal and backbone sections, scanner test results (Category 3, 4, or 5), fiber optic attenuation test results, OTDR traces, and green light test results shall be segregated by tab. Test data within each section shall be presented in the sequence listed in the administration records. The test equipment by name, manufacturer, model number and last calibration date will also be provided at the end of the document. 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. The test document shall detail the test method used and the specific settings of the equipment during the test.
2. Scanner tests shall be printed on 8-1/2" x 11". Hand written test results (attenuation results and green light results) shall be documented on an Excel spreadsheet. OTDR test results shall be printed or attached and copied on 8-1/2" x 11" paper for inclusion in the test documentation binder. Provide spreadsheet on a CD
3. 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 collocated in the binder.

3.07 RECORD DRAWINGS

- A. The installation contractor will be provided with two sets of drawings at the start of the project. One set will be designated for the central location to document all as-built information as it occurs throughout the project. The central set will be maintained by the Contractor's Foreman on a daily basis, and will be available to the Technical representative upon request during the course of the project. Anticipated variations from the building drawings may be for such things as cable routing and actual outlet placement. No variations will be allowed to the planned termination positions of horizontal and backbone cables, and grounding conductors unless approved in writing by the District. Contractor shall also redraw, with AutoCAD version 2004 or newer, the site and floor plans showing all fiber, copper, racks, and information outlets as well as the labeling scheme for all items. These CAD drawings shall be on 8-1/2" x 11" sheets of paper and disk, and be turned over to the District with the O&M manuals.
- B. The Contractor shall provide the central drawing set to the District at the conclusion of the project. The marked up drawing set will accurately depict the as-built status of the system including termination locations, cable routing, and all administration labeling for the cable system. In addition, a narrative will be provided that describes any areas of difficulty encountered during the installation that could potentially cause problems to the telecommunications system.

3.08 FIRESTOP SYSTEMS

- A. A firestop system is comprised of the item or items penetrating the fire rated structure; the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, heat, vapor and pressurized water stream.
- B. All penetrations through fire rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any

penetrating items i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly firestopped.

- C. Firestop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (P.E., licensed in the state where the work is to be performed. A drawing showing the proposed firestopped system, stamped/embossed by the cognizant PE shall be provided to the District's Technical Representative prior to installing the firestop system.
- D. All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.

3.09 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Provide services of a duly factory authorized service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.
- B. Inspection: Make observations to verify that units and controls are properly labeled, and interconnecting wires and terminal are identified. Provide a list of final tap settings of paging speaker line matching transformers.
- C. Testing:
 - 1. Provide all instruments for testing and demonstrating in the presence of the District's inspector that the system is operating as stated in the factory data sheets. Check all circuits and wiring to verify they are free of shorts and grounds. Perform all tests stated in each separate system specification.
 - 2. Rectify deficiencies indicated by tests and completely re-test work affected by such deficiencies at contractor's expense. Verify by the system test that the total system meets the specifications and complies with applicable standards.
 - 3. The District reserves the right to make independent tests of all equipment furnished to determine whether or not the equipment complies with the requirements specified herein and to accept or reject and or all of the equipment on the basis of the results thereby obtained.

3.10 CLEANING AND PROTECTION

- A. The contractor shall thoroughly clean all equipment and materials. All exposed parts of the equipment, cabinets, and other equipment shall be left in a clean condition, unblemished and free of all dirt, dust, smudges, spots, fingerprints, etc. The contractor shall remove all debris and rubbish occasioned by the electronic systems work from the site. The contractor shall thoroughly clean all buildings of any dirt, debris, rubbish, marks, etc., caused by the performance of this work.

3.11 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 District.
- B. The contractor shall maintain a competent service organization and shall, if requested, submit a service maintenance agreement to the District after the end of the guarantee period.
- C. A typewritten notice shall be posted at the equipment rack which shall indicate the firm, address and telephone number to call when service is necessary. The notice shall be mounted in a neatly finished metal frame with a clear plastic window and securely attached to the inside of the door.

D. Manufacturer Warranty

1. The contractor shall facilitate a 25-year system performance warranty between the manufacturer and the District. An extended component warranty shall be provided which warrants functionality of all cabling and connectivity components used in the system for 25 years from the date of acceptance. The performance warranty shall warrant the installed horizontal copper and both the horizontal and the backbone optical fiber portions of the cabling system. Copper and fiber optic links shall be warranted to the link or channel performance as defined in ANSI/EIA-568-C.
2. Upon completion of the project, the customer's technical representative will perform a final inspection of the installed cabling system with the contractor's project foreman. The final inspection will be performed to validate that all horizontal and backbone cables were installed as defined in the drawing package, and that the installation meets the aesthetic expectations of the customer.
3. Upon receipt of the test documentation, the customer reserves the right to perform spot testing of a representative sample of the cabling system to validate test results provided in the test document. Customer testing will use the same method employed by the contractor, and minor variations shall be allowed to account for differences in test equipment and test variability. If significant discrepancies are found, the contractor will be notified for resolution.
4. During the three week period between final inspection and delivery of the test and as-built documentation, the customer will activate the cabling system. The customer will validate operation of the cabling system during this period.
5. Completion of the installation, in-progress and final inspections, receipt of the test, receipt of the as-built documentation, and successful performance of the system for a two week period will constitute acceptance of the system.

E. Special Warranty

1. The contractor shall warrant the cabling system against defects in workmanship for a period of one year from the date of system acceptance. The warranty shall cover all labor and materials necessary to correct a failed portion of the system and to demonstrate performance within the original installation specifications after repairs are accomplished. All warranty repairs shall be done within fourteen days from being notified in writing by the District. This warranty shall be provided at no additional cost to the District.

END OF SECTION 271500

SECTION 27 41 16.51

INTEGRATED CLASSROOM AUDIO-VISUAL SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. All applicable portions of Division 26, Division 27, and Division 28 shall apply to this section as though written herein completely.

1.02 SCOPE OF WORK:

- A. The work under this section includes all labor, materials, equipment, and accessories required to furnish and install complete and fully functioning audio visual systems for classrooms as shown on the Construction Drawings.
- B. The systems shall provide the capability of switching between images from computers, DVD players, document cameras, or other A/V sources. The images will be routed to the LCD Projector in the classroom for display on a screen. Audio associated with the images shall be switched simultaneously to an amplifier which feeds ceiling (or wall) mounted loudspeakers located in the classroom.
- C. Announcements from the Public Address system shall interrupt the audio in the classroom system. When the PA announcement is complete, the classroom A/V system shall return to normal operation.
- D. The system shall be provided with a wireless voice amplification system equal to Extron Voicelift system.

1.03 RELATED WORK:

- A. The work described by this part includes the furnishing of all materials, equipment, supplies, labor and the performing of all operations necessary for the installation of complete and operating systems.
- B. All conduits, outlet boxes, back boxes, junction boxes, terminal cabinets, backboards, wiring, cables, equipment, devices, etc., shall be furnished and installed complete under this section. Conduit and junction box sizes shall be determined by the Installing Communications Contractor for the particular wire and cable fills required for the systems installed. (Conduit sizes shall comply with the National Electrical Code). The entire responsibility of the system, including the installation, operation, function, testing and maintenance for one (1) year after final acceptance under this section shall be the responsibility of the communications contractor.
- C. The Installing Communications Contractor shall furnish and install all equipment, cables, devices, and other materials even though not specifically mentioned herein, which are

necessary for the proper operation of the system so that the system shall perform the functions listed herein in compliance with all specified requirements.

1.04 GENERAL REQUIREMENTS

- A. The Installing Communications Contractor shall hold a valid State of California C-7 License, shall have completed at least 20 projects of equal scope, shall have been in business of furnishing and installing communication systems of this type for at least five years, and capable of being bonded to assure the District of performance and satisfactory service during the guarantee period.
- B. The Installing Communications Contractor shall hold all other licenses required by the legally constituted authorities having jurisdiction over the work
- C. The Installing Communications Contractor shall be a factory authorized distributor and warrantee station for the brand of equipment specified and shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment. The Installing Communication Contractor shall maintain a spare set of all major parts for the system at all times. All circuit boards, amplifiers and control sub systems shall be 100% backed up with stock at contractor's shop. The Contractor shall employ factory-trained technical/service personnel for service and maintenance of the system. Their resumes will be required. The factory-trained technical/service personnel shall have a minimum of five years' experience installing the proposed system.
- D. The installing Communication Contractor shall have a design staff with a BICSI certified (RCDD) Registered Communications Distribution Designer. The installing Communication Contractor shall have a factory trained service department. The service department shall be on call 24 hours a day, 365 days a year, to arrive and initiate onsite service the specified equipment upon (24) hours' notice.

1.05 DEFINITIONS

- A. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.

1.06 QUALITY ASSURANCE:

- A. In order to establish standards of performance the equipment specified for the Audio Visual system shall be as manufactured by Extron Electronics.
- B. All of the Electronic Systems Equipment shall be furnished and installed by the Authorized Factory Distributor of the equipment. The Contractor shall furnish a letter from the manufacturer of all major equipment, which certifies that the Installing Communication Contractor is the Authorized Distributor and that the equipment has been installed according to factory intended practices. The Contractor shall also furnish a written guarantee from the manufacturer that they will have a service representative assigned to this area for the life of the equipment.
- C. All communication systems supplied shall be listed by Underwriters Laboratories under UL Standard 1459. A copy of the UL listing card for the proposed system shall be included with the contractor's submittal.

- D. Comply with CEC.

1.07 SUBMITTALS

- A. Comply with all requirements of the General Conditions, Supplementary Conditions and applicable sections of Divisions 1 and 26 of these specifications.
- B. Additional requirements of this section are:
 - 1. Within thirty-five (35) calendar days after the date of award of the Contract, the Contractor shall submit to the Architect for review, eight copies of a complete submission.
 - 2. The submission shall consist of four 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.
- C. 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.
- D. The second section shall include a copy of the Installing Communication Contractors valid C-7 California State Contractors License, letters of Extron factory authorization and guaranteed service, list of 20 projects of equal scope and list of proposed instrumentation to be used by the Contractor.
- E. The third section shall contain an original factory data sheet for every piece of equipment in the specifications.
- F. The fourth section shall contain a wiring designation schedule for each circuit leaving each piece of equipment and drawings showing system wiring plans for a typical classroom.

PART 2 - PRODUCTS

2.01 AUDIO VISUAL SYSTEM

- A. Provide the following Audio/Visual equipment including associated outlets, cabling, patch cords and raceways for complete operable Audio Visual system per Grossmont Union High School District standard in each classroom and in each room as shown on the Construction Drawings.
- B. Projection System
 - 1. PoleVault Digital Classroom AV System, by Extron Electronics.
 - a. PVS 400D – including switching system, mounting, speakers, and all components for complete integrated operation of the PVS systems.
 - 2. Speakers – Quantities and locations as shown on the Construction Drawings.
 - a. Extron FF120 Flat Field speakers for drop ceiling locations.
 - 3. Wall Interfaces and Cabling – Quantities and locations as shown on the Construction Drawings.

- a. Controller – MLC 104 IP Plus.
 - 1) MLC PW/RS-232/VC-50': 50' Plenum rated Power, Switcher Communications, Volume Control cable.
 - 2) MLC IR/RS-232-50': 50' Plenum rated Projector Communications cable.
- b. PVT SW HDMI D: Digital Input, HDMI Decora wall plate.
 - 1) STP 201P: Plenum rated, shielded twisted pair communication cable with shielded connectors; length as required to reach PVS 405D switcher.
 - 2) HDMI Micro: 6' MicroDigital Ultra-Flexible HDMI cable; (1) per HDMI wall plate port.
- 4. Extron IR Emitter and Shield kit: Provide IR control for remote AV equipment.
- 5. Extron Page Priority Sensor: Priority Page Sensor connected to campus paging system.
 - a. Extron #PPS 35
- 6. (1) Extron UPB 25 Security Kit (70-555-01): A set of Hex Head Security Screws to replace the existing screws that normally ship with the Extron PoleVault projector mounts. No charge by manufacturer.
- 7. For standard classrooms with a drop ceiling:
 - a. Provide (1) Epson model 99W Ceiling Mounted LCD projector, and use the hardware provided with an Extron PoleVault system to mount it.
 - b. Provide (1) Draper, Silhouette Series M 16:9, auto-return, 57"x 83.5" or equal Pull down, high contrast grey matte projection screen.

C. Audio Visual Equipment

- 1. Provide (1) Sony BDP-S1100 Blu-ray DVD player, with a 4-year extended warranty, which shall be located in AV cabinet. Provide mounting brackets as required to mount unit inside AV cabinet. Provide safety belt power strip at each unit location. The Blu-ray/DVD unit will be connected by HDMI cable to the HDMI side of an Extron PVT SW HDMI D, mounted inside the AV cabinet.
- 2. Provide (1) Digital Visual Presenter, Elmo Model #TT-12. (Document Camera)
- 3. Provide (1) External CATV Tuner/Interface unit, AverMedia TVBOX 11, to be mounted on the side wall of the AV cabinet with wide Velcro tape. TVBOX 11 shall be oriented so that the IR sensor is visible to the user when the cabinet door is open, and controls on the top of the unit are accessible. Unit will input external coax from a cable outlet in the AV cabinet and output video through a VGA to HDMI adapter to be provided by the contractor, and audio, from a headphone port. Both, video, by a VGA cable and audio by a 3.5mm "stereo-mini" cable, will connect to an Extron PVT SW HDMI D in the AV cabinet.
- 4. A Bi-Directional coax coupler shall be installed, either in the AV cabinet or at the IDF location that allows two external coax connections for each classroom. One coax connection located in the AV cabinet for the Tuner/Interface unit, and one coax connection at the teacher's station for a video camera broadcast cart.

5. Outlets and faceplates as indicated on Classroom multi-media riser diagram. All face plates shall be white and shall include appropriate modular inserts to conform to system requirements.
6. Button designations on the MLC 104 IP Plus MediaLink Controller shall be:
 - a. CABLE TV (HDMI (1) in AV cabinet)
 - b. DVD (HDMI (2) in AV cabinet)
 - c. COMPUTER-HDMI (1) (Teacher computer w/ HDMI output)
 - d. COMPUTER-HDMI (2) (Teacher computer or other device w/ HDMI output)
7. All coax devices in the AV Cabinet are attached to the walls of the AV cabinet: CATV Tuner/Interface unit shall be attached using wide Velcro. The Bi-Directional coax coupler shall be attached using screws. The connecting coax, audio and VGA cables shall be neatly coiled and attached using screw-in cable clamps or fasteners.
8. At the Teacher's Desk Area: Provide (1) Extron PVT SW HDMI D interface for computer or document camera.
9. At the Teacher's Desk Area: Provide SF/UTP CAT6 cables with shielded connectors from the Teacher's Desk Area to the Extron PVS 405D switcher at the ceiling mounted projector location. Provide origin labeling on all cables.
10. One each of the following Extron devices shall be provided to the Site Technology Specialist as spare devices for testing and fast replacement during a repair:
 - a. PVT SW HDMI D
 - b. MLC 104 IP Plus

D. Classroom Audio Visual Patch Cables

1. All patch cables must be factory manufactured and color coded per owner's requirements to match each campus cabling. Equipment manufacturer's cables are not acceptable.
2. All VGA patch cables shall have ferrites attached by the cable manufacturer to minimize radio frequency interference.
3. RG6 coaxial cables shall be 6' in length and terminated with F-Type crimped connectors. 'Slide-on' cable connectors not permitted.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Mount the TV tuner vertically on the inside right wall of media cabinet near the bi-directional coupler. Mount using wide Velcro tape so that the remote receiver of the tuner faces the open cabinet door, 2" from the cabinet door edge and 1" from the cabinet ceiling.
- B. 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 prior to making any modifications. It shall

be the responsibility of the factory authorized distributor of the specified equipment to install the equipment and guarantee the system to operate as per plans and specifications.

- C. Furnish all conductors, equipment plugs, terminal strips, etc., and labor to install a complete and operable system.
- D. The cables within the rack or cabinets shall be carefully cabled and laced with no. 12 Cord waxed linen lacing twine or nylon cable ties. All cables shall be numbered for identification.
- E. Splicing of conductors in underground pull boxes is not permitted.
- F. 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 and architect to engage in the installation and service of this system.
- G. The contractor shall thoroughly clean all equipment and materials. All exposed parts of the equipment, cabinets, and other equipment shall be left in a clean condition, unblemished and free of all dirt, dust, smudges, spots, fingerprints, etc. The contractor shall remove all debris and rubbish occasioned by the electronic systems work from the site. The contractor shall thoroughly clean all buildings of any dirt, debris, rubbish, marks, etc., caused by the performance of this work.

3.02 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. The transmitter and receivers shall be warranted for parts and labor for a period of three (3) years by the manufacturer. Any material showing mechanical or electrical defects shall be replaced promptly at no expense to the District.
- B. The contractor shall maintain a competent service organization and shall, if requested, submit a service maintenance agreement to the District after the end of the guarantee period.
- C. A typewritten notice shall be posted at the equipment rack which shall indicate the firm, address and telephone number to call when service is necessary. The notice shall be mounted in a neatly finished metal frame with a clear plastic window and securely attached to the inside of the door.

3.03 TESTING

- A. Provide all instruments for testing and demonstrating in the presence of the District's inspector that the frequency response is as stated in the factory data sheets. Check all circuits and wiring to verify they are free of shorts and grounds. Perform all tests stated in each separate system specification
- B. The District reserves the right to make independent tests of all equipment furnished to determine whether or not the equipment complies with the requirements specified herein and to accept or reject any or all of the equipment on the basis of the results thereby obtained.

- C. Check out and final connections to the system shall be made by a factory-trained technician in the employ of a manufacturer of the products installed. In addition, factory-trained technicians shall demonstrate operation of the complete system and each major component to the District.
- D. System field wiring diagrams shall be provided to the District by the system manufacturer prior to completion of the installation.
- E. Upon completion of the installation of the equipment, contractor shall provide to the District a signed statement from the equipment manufacturer that the system had been tested and functions properly according to the specifications.
- F. The contractor shall be responsible to provide service within 24 hours (or by mutual consent) after notification by the District or his representative, within the hours of 8:00 AM to 5:00 PM from Monday to Friday. Service request forms shall be supplied by the Contractor and the faxing or mailing of such request form shall constitute notification by the District of a service request.

3.04 TRAINING

- A. Contractor shall provide a minimum of 40 hours of on-site training for site staff on the Classroom video systems. Training for personnel shall be provided by certified technology specialists. The scope of training shall encompass system operation and procedures. Technician training should include an integrated information overview, media retrieval procedures as well as operation procedures for local control configurations. The contractor shall provide a detailed written outline clearly describing the proposed plan for all training, for approval by the Engineer and District's representative.
- B. Training for staff will include basic system concepts. Faculty and staff will need to know how to power on/off the system, and how to access one or more media resources via remote control. Training should include use and operation of audio/video devices and techniques and trouble-shooting tips. Trainers should incorporate hands-on techniques to maximize staff opportunity to incorporate and develop curriculum that is both meaningful and targeted for their student needs. Clearly written support materials should be provided to all training participants. Manual describing operation and use of the system shall also be provided.
- C. Contractor shall provide a minimum of 4 hours of on-site training for technicians.
- D. Trainers shall provide technicians with an in-depth technical overview of head end or control system concepts. Training should include basic overview of head end and local control and troubleshooting concepts. Head end training should include system concepts and hands on usage of media sources. Media center technicians will be trained to provide setup, operation and application of return video. Clearly written documentation and support materials must be provided for each installation. A training manual describing operation and use of the system shall also be provided. Provide control of local resources and will be equipped with the required local switching and control capability. Provide required cables to integrate all local room devices including projectors, Plasma displays, DVD/NCR, Blu-ray and audio visual control system.

3.05 RECORD DRAWINGS

- A. The contractor shall maintain record drawings as specified in accordance with these specifications, and as noted below.
- B. Upon completion of the installation, four (4) copies of complete operational instructions shall be furnished, complete with record drawings. Instructions shall include part numbers and names, addresses, and telephone numbers of parts source. Final payment shall not be made until operational and maintenance manuals have been received.
- C. Drawings shall show locations of all concealed and exposed conduit runs, giving the number and size of conduit wires. Underground ducts shall be shown with cross section elevations and shall be dimensioned in relation to permanent structures to indicate their exact location. Drawing changes shall not be identified only with referencing CORs and RFIs, the drawings shall reflect all the actual changes made.
- D. One set of record drawings shall be delivered to the District in accordance with these specifications.

END OF SECTION 274116.51

SECTION 27 53 13

CLOCK SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. All applicable portions of Division 26, Division 27, and 28 shall apply to this section as though written herein completely.

1.02 SUMMARY

- A. The work under this section shall consist of all cabling, outlets, cabinets, patch panels, and associated material for a complete IP speaker-master clock system as shown on the plans and as specified herein.

1.03 RELATED WORK

- A. The work described by this part includes the furnishing of all materials, equipment, supplies, labor and the performing of all operations necessary for the installation of complete and operating systems.
- B. All conduits, outlet boxes, back boxes, junction boxes, terminal cabinets, backboards, wiring, cables, equipment, devices, etc. unless existing, shall be furnished and installed complete under this section. Conduit and junction box sizes shall be determined by the Installing Electrical Contractor for the particular wire and cable fills required for the systems installed. (Conduit sizes shall comply with the California Electrical Code). The entire responsibility of the system, including the installation, operation, function, testing and maintenance for one (1) year after final acceptance under this section shall be the responsibility of the installing electronic contractor.
- C. The Installing Electronic Systems Contractor shall furnish and install all equipment, cables, devices, and other materials even though not specifically mentioned herein, which are necessary for the proper integration of the system so that the system shall perform the functions listed herein in compliance with all specified requirements.

1.04 QUALIFICATIONS

- A. The installing Electronic Systems Contractor must be a CommScope (AMP) NETCONNECT certified contractor. Provide a copy of Contractor's CommScope AMP NETCONNECT certification with bid package. The Installing Electronic Contractor shall be an authorized CommScope AMP NETCONNECT PartnerPro business partner and shall provide 25 years extended product warranty and application assurance on this installation.
- B. The supplier of the equipment shall be an authorized AMP ND & I distributor and service facility.
- C. The Installing Electronic Systems Contractor shall hold a valid State of California C-7 license for all low voltage installations and a State of California C-10 License for any related high-voltage applications and shall have completed at least twenty projects including five projects with Grossmont Union High School District of equal scope, shall have been in business of furnishing and installing communication systems of this type for

at least ten years, and capable of being bonded to assure the District of performance and satisfactory service during the guarantee period.

- D. The Installing Electronic Systems 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 Contractor shall maintain a spare set of all major parts for the system at all times. All circuit boards, amplifiers and control sub systems shall be 100% backed up with stock at contractor's shop.

1.05 DEFINITIONS

- A. Backbone: A facility (e.g., pathway, cable, or conductors) between telecommunications rooms or floor distribution terminals, the entrance facilities, and the equipment rooms within or between buildings.
- B. BDF: Building Distribution Frame (same location as MDF)
- C. BICSI: Building Industry Consulting Service International
- D. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code
- E. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- F. EMI: Electromagnetic interference
- G. Horizontal Cabling: Cabling between and including the telecommunications outlet/connector and the horizontal cross-connect. Also the cabling between and including the building automation system outlet or the first mechanical terminations on the horizontal connection point and the horizontal cross-connect.
- H. IDC: Insulation displacement connector
- I. IDF: Intermediate Distribution Frame
- J. LAN: Local area network.
- K. MDF: Main Distribution Frame
- L. MTR: Main Telephone Room
- M. RCDD: Registered Communications Distribution Designer
- N. RMC: Rigid metallic conduit
- O. UTP: Un-shielded twisted pair cable

1.06 APPLICABLE STANDARDS

- A. The equipment shall be U.L. listed labeled, and approved for the application shown in the contract documents.
- B. The complete system material, equipment, testing, installation and workmanship shall comply with requirements of:

1. ANSI/TIA 568-C.0 Generic Telecommunications Cabling for Customer Premises
 2. ANSI/TIA 568-C.1 Commercial Building Telecommunications Cabling Standard
 3. ANSI/TIA 568-C.2 Balanced Twisted-Pair Telecommunications Cabling and Components Standards
 4. ANSI/TIA 568-C.3 Optical Fiber Cabling Components Standard
 5. EIA/TIA-TSB-36 Technical Systems Bulletin, Additional Cable Specifications for Unshielded Twisted-Pair Cables and all applicable revisions and addendums.
 6. ANSI/EIA/TIA-569 Commercial Building Standard for Telecommunications Pathways and Spaces and all applicable revisions and addendums.
 7. ANSI/EIA/TIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings and all applicable revisions and addendums.
 8. J-STD-607-A Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications and all applicable revisions and addendums.
- C. Products, services, and materials provided by the Contractor shall be new and of high quality and free of faults and defects.
- D. Provide products, services, and materials as specified in this document. Substitution of products, services, or materials will only be considered if the Contractor follows procedures and requirements specified in Section 013300.

1.07 SUBMITTALS

- A. Submit manufacturers' product data sheets for each component of the IP speaker-master clock systems. Certify that the data sheets depict the components to be provided by the Contractor to make up the complete system as described in this specification.
- B. Product Data
1. Material List: A material list with names of manufacturers, model numbers, and technical information on all equipment proposed.
 2. Product technical information sheets for each principal component in the proposed system. Identify by arrow, circle or similar means products being proposed. Submittals consisting of unmodified catalog pages with no markings will be rejected.
 3. Weight, dimensions and shipping splits.
 4. Equipment operating and service (maintenance) clearances required around the equipment.
- C. Shop Drawings
1. Include scaled plan of telecommunications equipment rooms, labeling each individual component. Identify voice data equipment racks, method of field assembly, workspace requirements, and access for cable connections.

2. Scaled drawings indicating all device locations and connections. Wire and conduit routing and circuit identification.
 3. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
 4. Cabling Administration Drawings
 5. Wiring diagrams to show typical wiring schematics including the following:
 - a. IP Speaker/Clocks
 - b. IP Interior and exterior speakers
 - c. IP interface equipment
 - d. Analog speaker cables
 - e. Terminal blocks
 - f. Equipment racks
- D. Qualification Data:
1. For Installer
 2. Submit references for a minimum of twenty similar projects successfully undertaken and completed within the last ten years. As a minimum, provide project name and address, client contact name and telephone number, and construction manager name and telephone number. Provide a brief description of each project indicating types of systems installed, quantities and configurations of outlets, and projected time scales.
- E. Operating Sequences: Provide a complete written description of the Sequence of Operation of each of the systems including startup and recovery procedures
- F. Samples: when requested by Architect
1. Provide three (3) full-size installation samples of the voice, data and IP speaker-clock system outlet. The sample shall include, as a minimum, the faceplate, two data and two voice system connectors (each terminated with a 12" length of distribution cabling) two blanking plates, and back boxes.
 2. Submit samples of the labels to be used for labeling cables, and termination blocks.
 3. Once samples have been submitted, reviewed by the School District Representative and approved they shall be retained. The samples shall be used as the standards by which the quality of work on the project by the Contractor shall be judged. Any installation, which does not meet this standard once samples have been submitted, reviewed by the School District Representative and approved, they shall be replaced or reworked as approved by the School District Representative.
- G. Operation and Maintenance (O&M) Manuals: Furnish composite "Systems Operation and Maintenance" manuals in indexed three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain, but not be limited to:
1. Operational procedures for the overall systems including the "Sequence of Operation".
 2. Test procedures and test results.

3. Instruction for the proper operation and maintenance of the system.
 4. Factory issued technical, installation, and maintenance manuals.
 5. Factory issued operations and programming (software) manuals.
 6. A replacement parts list complete with part numbers and name, address, and phone number of suppliers used by the Contractor. A spare parts list recommended for purchase by the District shall be included.
 7. All portions of the material list and shop drawings which are not included in the foregoing.
- H. Submit details of the warranty (including manufacturer warranties) to be provided for the cabling systems, clearly indicating that all components are covered.

1.08 COORDINATION

- A. Coordinate layout and installation of IP speaker- master clock cabling with District's Representative.
- B. Meet jointly with telecommunications and LAN equipment suppliers and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
 1. Record agreements reached in meetings and distribute to other participants.

1.09 SYSTEM TESTING

- A. Test Procedures:
 1. A written document detailing the proposed test procedures of the system shall be supplied. These procedures shall include all tests required by the equipment manufacturer and by this specification.
 2. Submit a testing schedule indicating how each IP speaker-master clock cabling system component is to be tested. Refer to Section 27 15 00 for testing requirements. The schedule shall, as a minimum, indicate the testing process from factory testing through to final acceptance testing. The schedule shall list (by part number) testing equipment that will be used and detail each step of each test to be performed. The schedule shall list the criteria that will be applied to each test of each component of the telephone and data cabling systems. The schedule shall include the test results form that will be filled in by the tester as each component is tested.
- B. Test Results Report: Test Results Report: The results of the execution of the testing procedure, including the items tested or inspected, the date, and by whom.
- C. Follow IP speaker-master clock system installation, undertake and record tests to ensure that the cabling and components will perform satisfactorily in service. In addition to the tests detailed in this specification, the Contractor shall carry out any additional tests that he deems necessary to ensure the satisfactory operation of the telephone, data, and fiber optic cable systems. Testing shall be as required in Section 27 15 00. The costs of these additional tests shall be borne by the Contractor.
- D. Provide the District's Representative with the opportunity to witness all testing.

- E. Complete the tests identified in all of the IP speaker-master clock system specifications.
- F. Notify the District's Representative fourteen working days before the date of commencement of the cable tests. Provide details, on that advance date, of proposed tests, the test schedule, equipment to be used, its certification and calibration, and the names and qualifications of test personnel.
- G. Include the cost of obtaining, calibrating, and maintaining test equipment, and the cost of carrying out and recording the tests, including labor costs, in the bid sum.
- H. Ensure that all Test Equipment is in calibration before delivery to site and throughout the testing period. The installer shall be responsible for ensuring that any necessary tests and rework to maintain equipment's calibration status are carried out.
- I. Failures detected during the testing shall be duly noted on the test results schedule and rectified. On the fault being rectified, this shall also be noted. These notes shall not be deleted or obliterated.
- J. Rectification of all damaged cables shall include replacing damaged cables with new cables in complete runs or remaking poor terminations. In-line cable joints, splices, or distribution points are not acceptable. All damaged cables shall be removed from site.

1.10 QUALITY ASSURANCE

- A. Work shall be done by a qualified Contractor holding licenses as required by legally constituted authorities having jurisdiction over the work. Contractor shall have completed at least ten (10) projects of equal scope to systems described herein and shall have been engaged in business of supplying and installing specified type of systems for at least 5 years.
- B. Contractor shall warranty all work executed and materials furnished shall be free from defects of material and workmanship for a period of two (2) years from acceptance date of Contract Completion. Immediately upon receipt of written notice from the District, Contractor shall repair or replace at no expense to the District: Any defective material or work which may be discovered before final acceptance or work, or within warranty period; any material or work damaged thereby; and adjacent material or work which may be displaced in repair or replacement.
- C. Examination of or failure to examine work by the District shall not relieve Contractor from these obligations.
- D. If Contractor fails to repair or replace material or work indicated above within 7 days of receiving written notice, the District, with its own personnel or by Contract, may proceed with repair or replacement and assess cost against Contractor, if Contractor does not respond accordingly.
- E. Persons skilled in trade shall install system in accordance with best trade practice. Further, in accordance with all applicable building codes.
- F. Contractor and all contractors' employees terminating cable to wiring terminating devices shall be certified by the manufacturer of the wiring device. Copies of certificates shall be provided to the District Representative prior to the start of work.
- G. Extend material and Performance Warranties

1. The contractor shall facilitate and extend to the Owner all manufacturers' warranties for all products installed. Extended system (performance) and component warranties shall be provided which warrants functionality of all existing and new components (cable, connecting hardware and patch cords) used in the system for a minimum of (5) five years from the date of acceptance. Each component of the system shall be covered for defects in materials and workmanship. Installers shall be factory trained technicians with a factory trained supervisor overseeing the project.
2. Repair or replace the defective material at the project premise, to comply with the performance standards outlined in the contract documents during the warranty period.
3. Upon successful completion of the installation and subsequent inspection, the District's Project Manager shall be provided with a numbered certificate, from the manufacturing company, registering the installation.
4. All conditions for obtaining the manufacturer's warranty shall be the sole responsibility of the contractor.

1.11 AS BUILT DOCUMENTATION

- A. Cable termination numbering, and patch panel labeling shall be coordinated with School District Representative.
- B. The as-built documentation shall consist of prints with the device locations, paging zone identification and cable routing.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: The IP Speaker Master Clock system shall be as manufactured by Singlewire/Berbee INFORMACAST. This is a board approved proprietary system. No other system will be considered.
- B. Source Limitations: Obtain materials and accessories from single source from single manufacturer.

2.02 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.
- B. Comply with CEC.

2.03 IP SPEAKER / MASTER CLOCK OUTLETS

- A. Cabling and data outlet shall conform to the requirements of Section 27 15 00.
 1. Outlet for IP clock/speaker shall be RJ45 enhanced performance type 8-position/8-conductor module jack, and shall comply with enhanced category 6A performance requirements, number of ports and quantities as indicated on drawings. All outlets shall be wired in the TIA 568B configuration.

2. Provide 110 SL series two-port almond color surface mount module, CommScope AMP NETCONNECT part# 1933668-1 with SL Series Category 6A gray color AMP-TWIST, COMMScope AMP NETCONNECT part# 1933476-4 with strain relief cap for IP clocks, IP speakers and IP clock/speakers outlet locations. Locate jack inside enclosure.

2.04 COMBINATION IP CLOCK/SPEAKER

- A. School District IT Department will furnish, install and program all combination IP clock/speakers. The low voltage contractor shall be responsible to provide enclosures, cables and patch cords for combination IP clock/speakers per School District requirements.
- B. The low voltage contractor shall be responsible to provide suitable surface mounted enclosures with vandal resistant for all combination IP clock/speakers location as indicated on drawings. Obtain cut sheets all devices and coordinate enclosure type with School District prior to ordering. Coordinate installation of enclosure with electrical contractor. Submit sample of each enclosure to School District IT Department for approval prior to ordering. Provide following type enclosures:
- C. Surface wall mounted enclosure, Atlas Sound #SEA-I8SC for combination IP clock/speakers.
- D. \
- E. Provide 2 foot category 6A gray color patch cable assembly per Section 27 15 00 to connect to data drop at each location.
- F. Provide 4 foot category 6A gray color patch cable assembly per Section 27 15 00 to connect all devices to District provided Ethernet switch at IDF location. Coordinate with School District IT Department for final connections.
- G. Coordinate testing and adjusting of speakers as required with School District IT Department.

2.05 GROUNDING AND BONDING

- A. Grounding and bonding shall comply with CEC, EIA/TIA-607 and UL467.
- B. All wires used for telecommunications grounding purposes shall be identified with green insulation. Non-insulated wires shall be identified at each termination point with a wrap of green tape. All cables and bus bars shall be identified and labeled in accordance with the System Documentation Section of this specification.

PART 3 - EXECUTION

3.01 CABLE INSTALLATION

- A. Cables connecting to equipment racks shall be installed with not less than six feet of slack cable between the equipment rack/terminal block and terminal backboard. The slack cable shall be coiled and supported on the backboard and/or cable tray.
- B. Cables shall be trained, dressed and racked on the plywood backboards. Provide cable, metal support arms and re-enterable type cable support rings not less than 12 inches on center mounted onto the plywood along the entire length of all cables.

- C. Provide 36 inches of cable slack at clock outlets.
- D. The minimum bending radius for copper wire cables shall be 10 times the cable outside diameter. The maximum pulling tension and minimum bending radius shall not violate manufacturer's recommendations.
- E. Cable lengths over 50 feet shall be machine pulled and not hand pulled. Cables shall be pulled in a continuous, smooth operation without jerking or stop-start motion after initiation of pull. Maximum cable pulling speed shall be less than 50 feet per minute. Minimum cable pulling speed shall be greater than 15 feet per minute.
- F. A dynamometer to measure pulling tension shall be used on all cable runs in excess 200 feet or with more than 180 degrees in bends. The actual pulling tension value shall be calculated and recorded for each pull. A written report shall be provided to the District.
- G. The portions of cables installed without raceways or cable tray supports shall be installed with "J-hook" cable supports.
- H. The "J-hooks" shall provide multi-tiered "treed" "J" shared hooks, with wide flat cable support base (0.5"W minimum) and smooth rounded corners, specifically designed for Category-6 and fiber optic cable support. As manufactured by Erico Inc. or substitution of equal or better and approved by the District.
 - 1. The individual "J-hook" attachment to the building structure shall be "beam clamp", "hanger rod", clevis hanger styles.
 - 2. Install "J-hooks" not more than 36 inches on center along the entire cable length, at each cable change in direction, to insure less than 6 inches of cable sag between adjacent hooks. Secure cables to "J-hooks" with cable tie wraps. "J-hooks" supported cables, bundle cables together with tie wraps.
 - 3. "Bridle rings" shall not be used to support cables.
 - 4. Cables shall not rest directly on ceilings, ceiling hangers, lighting fixtures, air ducts, piping, or equipment.
- I. Provide nylon pull strings with all cable runs, conduit stub ups, conduit sleeves, cable trays, open wiring routes, innerduct, and spare. Pull strings shall be free from cable bundles in open wiring routes.
- J. Provide Velcro cable management straps on all copper cable bundles, the last 20 feet or upon entry into equipment closet, a maximum of 12 inches apart, on the rear of the equipment racks and on the patch cords within the vertical cable managers. Straps shall be a maximum of 12 inches apart.

3.02 CIRCUIT TERMINAL ROOMS AND CLOSETS

- A. Provide conductor/cable training and racking support distribution rings installed on backboards. Support rings shall be spaced a minimum of 10 inches on center along all cable/conductor routing paths on backboards and within 4 inches of each change in cable/conductor direction. As manufactured by Newton 3042 series, Saunders or equal with District approval.

3.03 LABELING AND IDENTIFICATION

- A. Each cable run shall be permanently labeled at each end with a unique sequential number which corresponds to a similar number provided for each data outlet and punch down point. A printed label shall be placed at each of the following locations:
- B. On cable at the rear of the patch panel or termination block, provide self-laminating wrap around label, Brady Label self-laminating 1.2" by 1.5" wrap around label #29689 or equal to match site condition.
- C. On each cable in the j-box behind the faceplate location. Provide self-laminating wrap around label, Brady Label self-laminating 1.2" by 1.5" wrap around label #29689 or equal to match site condition.
- D. On the face plate of the patch panel, provide a ¾" by ¾" label with a letter or number identifying the patch panel designation.
- E. On the face of the faceplate in the label holder window.

3.04 CABLE SYSTEM TESTING

- A. All cables and termination hardware shall be 100% tested for defects in installation to verify cable performance under installed conditions. All conductors of each installed cable shall be verified useable by the contractor prior to system acceptance. Any defect in the cable system installation including but not limited to cable, connectors, feed-through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.
- B. Each copper cable shall be tested for continuity on all pairs and/or conductors. Twisted-pair data cables shall be tested for the all of the above requirements, plus tests that indicate installed cable performance. All category 6A cables shall be tested to ensure the category 6A standard performance to 500Mhz is complied with. All tests shall be printed out in hard copy in the quantity called out in the general specifications for O&M and turn over documents as well as one disc copy for the owners use. Data cables shall be tested using a (Fluke – DSP 4000 series or equivalent) cable analyzer.
- C. Continuity
 - 1. Each pair of each installed cable shall be tested using a "green light" test set that shows opens, shorts, polarity and pair-reversals. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicted 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 prior to final acceptance.

3.05 RECORD DRAWINGS

- 1. The installation contractor will be provided with two sets of drawings at the start of the project. One set will be designated for the central location to document all as-built information as it occurs throughout the project. The central set will be maintained by the Contractor's Foreman on a daily basis, and will be available to the Technical representative upon request during the course of the project. Anticipated variations from the building drawings may be for such things as cable routing and actual outlet placement. Contractor shall also redraw, with AutoCAD

version 2004 or newer, the site and floor plans showing all fiber, copper, racks, and information outlets as well as the labeling scheme for all items. These CAD drawings shall be on 8-1/2" x 11" sheets of paper and disk, and be turned over to the owner with the O&M manuals.

2. The Contractor shall provide the central drawing set to the owner at the conclusion of the project. The marked up drawing set will accurately depict the as-built status of the system including termination locations, cable routing, and all administration labeling for the cable system. In addition, a narrative will be provided that describes any areas of difficulty encountered during the installation that could potentially cause problems to the telecommunications system.

3.06 FIRESTOP SYSTEMS

- A. A firestop system is comprised of the item or items penetrating the fire rated structure; the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, heat, vapor and pressurized water stream. All penetrations through fire rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating items i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly firestopped.
- B. Firestop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE), licensed in the State of California. A drawing showing the proposed firestopped system, stamped/embossed by the PE shall be provided to the Owner's Technical Representative prior to installing the firestop system.
- C. All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.

3.07 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Provide services of a duly factory authorized service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.
- B. Inspection: Make observations to verify that units and controls are properly labeled, and interconnecting wires and terminal are identified. Provide a list of final tap settings of paging speaker line matching transformers.
- C. Testing:
 1. Provide all instruments for testing and demonstrating in the presence of the owner's inspector that the system is operating as stated in the factory data sheets. Check all circuits and wiring to verify they are free of shorts and grounds. Perform all tests stated in each separate system specification.
 2. Rectify deficiencies indicated by tests and completely re-test work affected by such deficiencies at contractor's expense. Verify by the system test that the total system meets the specifications and complies with applicable standards.
 3. The owner reserves the right to make independent tests of all equipment furnished to determine whether or not the equipment complies with the requirements

specified herein and to accept or reject and or all of the equipment on the basis of the results thereby obtained.

3.08 CLEANING AND PROTECTION

- A. The contractor shall thoroughly clean all equipment and materials. All exposed parts of the equipment, cabinets, and other equipment shall be left in a clean condition, unblemished and free of all dirt, dust, smudges, spots, fingerprints, etc. The contractor shall remove all debris and rubbish occasioned by the electronic systems work from the site. The contractor shall thoroughly clean all buildings of any dirt, debris, rubbish, marks, etc., caused by the performance of this work.

3.09 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 District.
- B. 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.
- C. A typewritten notice shall be posted at the equipment rack which shall indicate the firm, address and telephone number to call when service is necessary. The notice shall be mounted in a neatly finished metal frame with a clear plastic window and securely attached to the inside of the door.
- D. Manufacturer Warranty
 - 1. The contractor shall facilitate a 5-year system performance warranty between the manufacturer and the owner. An extended component warranty shall be provided which warrants functionality of all cabling and connectivity components used in the system for 5 years from the date of acceptance.
 - 2. Upon completion of the project, the District's technical representative will perform a final inspection of the installed cabling system with the contractor's project foreman.
 - 3. Upon receipt of the test documentation, the District reserves the right to perform spot testing of a representative sample of the cabling system to validate test results provided in the test document. District testing will use the same method employed by the contractor, and minor variations shall be allowed to account for differences in test equipment and test variability. If significant discrepancies are found, the contractor will be notified for resolution.
- E. Special Warranty
 - 1. The contractor shall warrant the cabling system against defects in workmanship for a period of one year from the date of system acceptance. The warranty shall cover all labor and materials necessary to correct a failed portion of the system and to demonstrate performance within the original installation specifications after repairs are accomplished. All warranty repairs shall be done within fourteen days from being notified in writing by the District. This warranty shall be provided at no additional cost to the District.

END OF SECTION 275313

SECTION 26 16 00

INTRUSION DETECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. All applicable portions of Division 26, Division 27, and Division 28 shall apply to this section as though written herein completely.

1.02 SUMMARY

- A. This section describes, in an overview fashion, the Electronic Safety and Security Systems scope of work for the SYSTEMS INTEGRATOR on the project. This section includes intrusion detection with communications links to perform monitoring, alarm, and controls for intrusion detection of the Facility.
- B. Furnish all labor, materials, equipment, and service necessary for a complete and operating Intrusion Detection System as shown on the drawings and as described herein. Drawings are diagrammatic only.
- C. All labor, material, equipment and software not specifically referred to herein or on the plans that are required to meet the functional intent of this specification, shall be provided without additional cost to the District.
- D. The District shall be the named license holder of all software associated with any and all incremental work on the project(s).

1.03 SYSTEM DESCRIPTION

- A. Provide materials, equipment, fabrication, installation and tests in conformity with applicable Codes and Authorities Having Jurisdiction for the Grossmont Union High School District, Valhalla High School modernization project:
- B. Security Contractor to provide all software, hardware, and programming for installation, connection and operation of the new intrusion alarm system equipment.
- C. Provide installation, testing, adjustment and initial programming for all equipment and systems.
- D. Security Contractor is responsible for fully implementing the functions described in the Specifications.
- E. Coordinate all telephone and data network connections, programming, and requirements with Owner's representative.
- F. Provide training to the Owner in the operation, programming, adjustment, servicing, troubleshooting and repair of the intrusion alarm system.
- G. Provide proposed naming conventions for equipment listed under this Section to the Owner 30 days prior to programming.

- H. Conduit, wire and cable installations performed under this Division shall comply with all applicable sections of the Local Building Codes, National Electrical Code and requirements.

1.04 DEFINITIONS

- A. CCTV: Closed-circuit television.
- B. PIR: Passive Infrared
- C. RFI: Radio-frequency interference.
- D. UPS: Uninterruptible power supply.
- E. LAN: Local Area Network
- F. Control Unit: System component that monitors inputs and controls outputs through various circuits.
- G. Master Control Unit: System component that accepts inputs from other control units and may also perform control-unit functions. The unit has limited capacity for the number of protected zones and is installed at an unattended location or at a location where it is not the attendant's primary function to monitor the security system.
- H. Monitoring Station: Facility that receives signals and has personnel in attendance at all times to respond to signals. A central station is a monitoring station that is listed.
- I. Protected Zone: A protected premises or an area within a protected premise that is provided with means to prevent an unwanted event.
- J. Standard Intruder: A person who weighs 100 lb. (45 kg) or less and whose height is 60 inches (1525 mm) or less; dressed in a long-sleeved shirt, slacks, and shoes.
- K. Standard Intruder Movement: Any movement, such as walking, running, crawling, rolling, or jumping, of a "standard intruder" in a protected zone.
- L. System Integration: The bringing together of components of several systems containing interacting components to achieve indicated functional operation of combined systems.
- M. Zone: A defined area within a protected premise. It is a space or area for which an intrusion must be detected and uniquely identified. The sensor or group of sensors must then be assigned to perform the detection, and any interface equipment between sensors and communication must link to master control unit.

1.05 ACTION SUBMITTALS

- A. Product Data: Components for sensing, detecting, systems integration, and control, including dimensions and data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: Detail assemblies of standard components that are custom assembled for specific application on this Project.
- C. Functional Block Diagram: Show single-line interconnections between components including interconnections between components specified in this Section and those furnished under other Sections. Indicate methods used to achieve systems integration.

Indicate control, signal, and data communication paths and identify control interface devices and media to be used. Describe characteristics of network and other data communication lines.

1. Indicate methods used to achieve systems integration.
 2. Indicate control, signal, and data communication paths and identify networks, control interface devices, and media to be used.
 3. Describe characteristics of network and other data communication lines.
 4. Describe methods used to protect against power outages and transient voltages including types and ratings of isolation and surge suppression devices used in data, communication, signal, control, and ac and dc power circuits.
- D. Raceway Riser Diagrams: Detail raceway runs required for intrusion detection. Include designation of devices connected by raceway, raceway type and size, and type and size of wire and cable fill for each raceway run.
- F. Site and Floor Plans: Indicate final outlet and device locations, routing of raceways, and cables inside and outside the building.
- G. Master Control-Unit Console Layout: Show required artwork and device identification.
- H. Device Address List: Coordinate with final system programming.
- I. System Wiring Diagrams: Include system diagrams unique to Project. Show connections for all devices, components, and auxiliary equipment. Include diagrams for equipment and for system with all terminals and interconnections identified.
- J. Details of surge-protection devices and their installation.
- K. Sensor detection patterns and adjustment ranges.
- L. Equipment and System Operation Description: Include method of operation and supervision of each component and each type of circuit. Show sequence of operations for manually and automatically initiated system or equipment inputs. Description must cover this specific Project; manufacturer's standard descriptions for generic systems are unacceptable.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Intrusion detection systems integrator and installer.
- B. Field quality-control reports.
- D. Other Information Submittals:
1. Test Plan and Schedule: Test plan defining all tests required to ensure that system meets technical, operational, and performance specifications within 60 days of date of Contract award.

1.07 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For intrusion detection system to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:

- B. Data for each type of product, including features and operating sequences, both automatic and manual.
- C. Master control-unit hardware and software data.

1.08 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Intrusion Detection Devices: Furnish quantity equal to five percent of the number of units of each type installed, but no less than one of each type.
 - 2. Fuses: Three of each kind and size.

1.09 SOFTWARE LICENSE AGREEMENT

- A. The District shall agree to the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to District as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software.
- B. The District shall be the named license holder of all software associated with any and all incremental work on the project(s). In addition, the District shall receive ownership of all job specific configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job specific software code and documentation for all configuration and programming that is generated for a given project and/or configured for use with the Security Controller and any related LAN / WAN / Intranet and Internet connected routers and devices. Any and all required IDs and passwords for access to any component or software program shall be provided to the District.

1.10 DELIVERY, STORAGE AND HANDLING

- A. Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons through shipping, storage, and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.

1.11 JOB CONDITIONS

- A. Cooperation with Other Trades: Coordinate the Work of this section with that of other sections to ensure that the Work will be carried out in an orderly fashion. It shall be this Contractor's responsibility to check the Contract Documents for possible conflicts between his Work and that of other crafts in equipment location, pipe, duct and conduit runs, electrical outlets and fixtures, air diffusers, and structural and architectural features.

1.12 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Intrusion Detection Systems Integrator Qualifications: An experienced intrusion detection equipment supplier and Installer who has completed systems integration work for installations similar in material, design, and extent to that indicated for this Project,

whose work has resulted in construction with a record of successful in-service performance.

- C. 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.
- D. Control Units, Devices, and Communications with Monitoring Station: Listed and labeled by a qualified testing agency for compliance with SIA CP-01.
- E. FM Global Compliance: FM-Approved and -labeled intrusion detection devices and equipment.
- F. Comply with NFPA 70.

1.13 PROJECT CONDITIONS

- A. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
 - 1. Altitude: Sea level to 4000 feet (1220 m).
 - 2. Master Control Unit: Rated for continuous operation in an ambient of 60 to 85 deg F (16 to 29 deg C) and a relative humidity of 20 to 80 percent, noncondensing.
 - 3. Interior, Controlled Environment: System components, except master control unit, installed in temperature-controlled interior environments shall be rated for continuous operation in ambients of 36 to 122 deg F (2 to 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing.
 - 4. Interior, Uncontrolled Environment: System components installed in non-temperature-controlled interior environments shall be rated for continuous operation in ambients of 0 to 122 deg F (minus 18 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing.
 - 5. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambients of minus 30 to plus 122 deg F (minus 34 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, condensing. Comply with UL 294 and UL 639 for outdoor-use equipment. Rate for continuous operation when exposed to rain as specified in NEMA 250, winds up to 85 mph (137 km/h).
- B. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers or flyings shall be rated, listed, and installed according to NFPA 70.

1.14 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer and Installer agree to repair or replace components of intrusion detection devices and equipment that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 INTRUSION DETECTION SYSTEM PRODUCTS

- A. Contractor to provide and install Digital Monitoring Products, Incorporated (DMP) equipment as identified within the specifications and unless otherwise noted.
- B. Contractor shall provide (1) XR500N Command Processor Panel as indicated on Construction Drawings.
- C. Detection equipment shall be hard-wired and communicate to the system by way of the control panel expansion bus and meet or exceed features offered in the following products:
 - 1. Wall Motion Detector – Optex Model DX-40 or DX-60
 - 2. Ceiling Motion Detector – Optex Model FX-360
 - 3. Bus Splitter/Repeater Module – DMP Model 710
 - 4. Zone Expansion Module - DMP Model 714-8
 - 5. Keypad – DMP Model 7063W Thinline LCD Keypad with Proximity card reader capabilities.
- D. Contractor to perform all programming of each school's independent intrusion detection system to ensure a complete and working system to the Owner's satisfaction. Coordinate with the Owner specific areas within the building to be armed. Coordinate with the Owner user access levels for the system and program a minimum of fifty users and pass codes for the initial startup of the system. System shall report all "Opening" and "Closing" reports by individual user.
 - 1. Security Contractor to install DMP intrusion detection systems in a locked enclosure with a tamper switch.
 - 2. Security Contractor to coordinate the installation of network and telephone line connections inside the enclosure.
 - 3. Security Contractor to install the arming station keypads at locations identified and coordinated with Owner.
- E. Motion Detectors
 - 1. Security Contractor to provide and install directional or 360 degree motion detectors at every classroom, office, hallway, conference room, meeting room, work room, lounge, kitchen, multipurpose room, library, and any restroom with an exterior door or exterior window.
 - 2. Intrusion detectors shall be independently wired "homerun" to closest IDF location and combined into alarm zones ONLY within distinct sections, wings, or areas within the school.
 - 3. Areas and zones must be identified in Contractor shop drawings and submitted for approval prior to installation.
 - 4. Each detector shall have an EOL resistor at the detector.
 - 5. Resistors shall be installed at the EOL as a pre-manufactured device with values to match the system installed.
- F. Labels
 - 1. All labels for all cabling, power supplies, AC power cords and any connection to the security equipment shall be clearly labeled to identify the connected device or purpose. Labels shall be vinyl wrap with clear over lay so as not to become

unraveled and shall not be made of plastic. Labels shall be placed as close to the wire termination point as possible and not placed on equipment that can be removed or replaced.

2. All labels for security equipment shall be clearly applied so as to easily identify the device or system served. Provide labels for all mounted and installed equipment including the exterior of enclosures, power supplies, UPS and other equipment. Labels shall be vinyl and not made of plastic.

G. Tamper Switches

1. Security contractor to provide and install plunger type tamper switches on all new enclosures and power supplies.

2.02 WIRE AND CABLE

A. Wire and Cable Specifications

1. Security Contractor shall follow the manufacturers' recommendation and contract document's intrusion system riser diagram for minimum wiring/cabling requirements.
2. Cables are to be shielded as necessary to preclude any outside noise or interference from entering the cable and degrading system performance. All cables shall be U.L. Listed, and appropriate for the application.
3. Use proper grounding practices to eliminate shorts, ground faults, ground loops, RF interference, voltage fluctuations, foreign voltages, and open circuits.
4. Coordinate with the Owner's representative for telephone line requirements and location for off- site monitoring.
5. Cables run underground, under slab, or in slab shall be installed in conduit and rated for direct- burial application. Cables above hard ceiling or inaccessible areas shall be installed in conduit or 'stub-up' conduits from within walls into accessible spaces.
6. All cables run in environmental air handling spaces shall be plenum rated. Utilize existing cable pathway where available and provide proper J-hook support for cables not run in conduit.
7. All Cable shall be run in unbroken lengths of 1000 feet or less. No power cables less than 1000 feet shall be spliced. When cable cannot be run in unbroken lengths due to cable spool limitations, splices shall be made in junction boxes with terminal blocks or terminal strips and fork spade lugs. All splices and junction boxes shall be clearly marked on the "As-Built" Record Drawings.
8. All wire to wire splices not utilizing terminal blocks or terminal strips shall be done with solder and heat shrink. Wires shall be individually soldered, then neatly heat shrink together to form the narrowest splice possible for ease of installation and removal, as well as overall protection of the splice. The use of all crimp type and screw type connectors i.e. beans, top hats, butt connectors, snap caps, wire nuts, and the "twist and tape" method are prohibited.
9. All End-of-Line supervision resistors shall be installed at the individual protection devices, and not in the control panels.
10. Wiring shall be grouped and harnessed to facilitate access to all equipment, as well as maintenance and replacement of equipment.
11. All cable shall be labeled at origin and termination, referencing to a master legend schedule as shown on "As-Built" Record Drawings. Labeling and any splice locations shall be noted on "As-Built" Record Drawings. All labels shall be done using machine generated cable tags in the "flagged" position. Hand written labels are not acceptable.

12. Cabling shall be sized and installed according to California Electric Code requirements.
13. Any cabling or raceway exposed to weather shall be rated for that use.
14. All final labeling shall be with machine-generated printed labels, specifically made for cable labeling. No handwritten labels will be accepted. All wiring including power cords and feeds, network connections, and system cabling shall be fitted with a machine generated label identifying the device or point served. The id marker for each label shall have the device number and name.
15. Each enclosure shall have a security As-Built Drawing with point list and naming / numbering to match the machine generated labeling on cables terminated to the panels and power supplies.

PART 3 - EXECUTION

3.01 REQUIREMENTS

- A. Systems shall be complete and operational in all respects.
- B. Security Contractor shall furnish and install all equipment for intrusion detection systems.
- C. Security Contractor shall furnish and install all wiring recommended by submitted system manufacturers and contract documents for optimum system performance at no increase in Contract price.
- D. Security Contractor is required to provide, install, and connect electrical power to the intrusion alarm panels as needed.
- E. Security Contractor shall provide the Owner with a minimum of four complete sets of keys for all equipment installed in this Project prior to the close of the Project. All keys relating to the security systems shall be kept separate from the building systems and delivered to the Owner's representative.

3.02 RECORD DRAWINGS

- A. Maintain a complete set of "As-Built" Record Drawings updated with mark-ups inserted as the Work is performed. As Work is installed carefully mark on "As-Built" Record Drawings in colored pencil the correct location of all Work including depth of underground runs and concealed Work with their dimensions from clearly identified points on permanent buildings, fixtures, walls, or walks. Wiring diagrams, risers and details shall be included.
- B. Upon completion of the Project, transfer hand-drawn information to CAD Drawings (if possible) then copy updated CAD Drawings onto compact disc and submit to the Owner and Security Consultant. No hand-drawn "As-Built" Record Drawings will be accepted. Provide one electronic set in PDF.
- C. "As-Built" Record Drawings shall be provided in four plotted sets as well as one set of CAD Drawings on compact disc to the Owner and Security Consultant. One additional complete half-size plotted set shall remain on the Project site in folders secured near the Intrusion Alarm Panel.

3.03 TRAINING

- A. Training shall be by technicians highly skilled in the systems installed and factory trained and certified by the manufacturer as qualified to train in the particular systems.

- B. Provide six hours of scheduled training for the equipment furnished under this Section, including programming, operation, service, and maintenance.
- C. Training shall be conducted at dates and times directed by the Owner. Training shall be provided for all Owner designated personnel.
- D. Documentation of completion of training shall be delivered to and verified by the Owner prior to release of retainage.

3.04 OPERATOR INSTRUCTION, TRAINING

- A. During system commissioning and at such time acceptable performance of the intrusion detection hardware and software has been established, this contractor shall provide on-site operator instruction to the District's operating personnel. Operator instruction shall be done during normal working hours and shall be performed by a competent representative familiar with the system hardware, software and accessories.
- B. This contractor shall provide 12 hours of instruction to the District's designated personnel on the operation of the ACMS and describe its intended use with respect to the programmed functions specified. Operator orientation of the systems shall include, but not be limited to; the overall operation program, access control functions, commands, advisories, and appropriate operator intervention required in responding to the System's operation.
- C. The training shall be in three sessions as follows:
 - 1. Initial Training: 1/2-day session (4 hours) after system is started up and at least one week before first acceptance test. Manual shall have been submitted at least two weeks prior to training so that the Districts' personnel can start to familiarize themselves with the system before classroom instruction begins.
 - 2. First Follow-Up Training: 1/2 day (4 hours total) approximately two weeks after initial training, and before Formal Acceptance. These sessions will deal with more advanced topics and answer questions.
 - 3. Warranty Follow Up: 1/2 day (4 hours total), to be scheduled at the request of the District during the one year warranty period. These sessions shall cover topics as requested by the District such as; how to add additional points, how to query and modify reports, graphic screen generation or modification of floor plans.

END OF SECTION 2811600

SECTION 28 23 00

VIDEO SURVEILLANCE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. All applicable portions of Division 26, Division 27, and Division 28 shall apply to this section as though written herein completely.

1.02 SUMMARY

- A. Furnish all materials, equipment and labor, and perform all operations in connection with video surveillance systems work as indicated on the drawing, as specified herein and required to complete the work.
- B. The conduit, outlets, terminal cabinets, device backboxes, security screws etc., which form a part of the rough-in work, shall be furnished and installed completed by the Electrical Contractor. Video surveillance system components as listed under products shall be furnished and installed by the authorized Contractor or Subcontractor.

1.03 DEFINITIONS

- A. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.

1.04 QUALITY ASSURANCE

- A. All security video surveillance system components shall be manufactured by and wiring shall be furnished and installed by a factory authorized contractor and distributor. The Contractor shall hold a license from the State of California for the purpose of installing security systems and shall have a minimum of 5 years of documentable experience with the installation and repair of the type of equipment to be installed.
- B. Installing Video Surveillance Contractor qualifications: Firms and their personnel must be regularly engaged in the installation of video surveillance system cabling and equipment for systems of similar type and scope. The contractor must have a full service office able to respond to emergency callouts during the warranty period. The contractor must also provide complete installation of all wiring and devices or equipment. Subcontracts with electrical contractors or Network Integration Companies shall be allowed for installation of specific services or special equipment. Video surveillance contractor's personnel with supervised installation of electrical or network electronics is not approved. All work by a subcontractor must be started and completed by the specialty contractor. All conduit and standard back boxes will be furnished and installed by the electrical contractor. Specialty boxes will be furnished by the equipment supplier and installed by the electrical contractor. Supervised installation for the wiring and devices shall be permitted with the following conditions:
 - 1. A letter will be required from the camera system manufacturer's representative certifying that the cable installation was completed in compliance with the manufacturer's recommended installation requirements.

2. The cables shall be tested in the presence of the manufacturer's representative. These tests will then be submitted to the electrical engineer.
 3. The security system shall be warranted by the manufacturer's representative per the contract agreement.
- C. In order to ensure project cohesion, a single point of contact is required to provide a "TURNKEY" solution. The work covered under this section of the specification consists of furnishing all labor; equipment; software; supplies; materials, and training. The Contractor will perform all operations necessary for the "TURNKEY" and fully completed installation in accordance with the specifications herein. As such, the successful contractor must be factory trained on all aspects of system hardware.

1.05 SUBMITTALS

- A. Phase I Submittal shall be made within (30) working days after the award of the contract by the District. This submittal shall include the following:
1. Complete bills of quantities, including all materials, components, devices, and equipment required for this work. The bills of quantities shall be tabulated respective of each and every system as specified, and shall contain the following information for each item listed:
 - a. Description and quantity of each item.
 - b. Manufacturer's Name and Model Number.
 - c. Manufacturer's Specification Sheet.
 - d. Description of any specialty backbox requirements.
 - e. All wiring types required for installation of this system.
- B. Phase II – Shop Drawings. Submittal shall be provided within (20) working days after the approval of the Phase I submittals and prior to any fabrication or field conduit installations. All shop drawings shall be engineered and drawn on a CAD System. Each submission shall include "D" or "E" size print copies to match the contract drawings, and (1) data disk copy with files in a AutoCAD format. If the contractor wishes to use the Architect's backgrounds, contractor shall make the request for the specific drawings in writing directly to the architect of record, confirmation of the request and a release form will be forwarded to the Contractor for signature. Provide complete design shop drawings to include:
1. Complete floor plans showing the locations throughout the project of all receptacles, conduits, wireways, tray, pullboxes, junction boxes, equipment locations, and other devices.
 2. Typical system riser diagrams, specialty equipment or rack elevations will be required to be provided.
- C. Phase II submittal shall be provided within (20 working days) after the approval of the Phase I submittals and prior to any fabrication or field conduit installations. All shop drawings shall be engineered and drawn on a CAD system. Each submission shall include 'D' or 'E' size print copies to match the contract drawings, and (1) data disk copy with files in AutoCAD 2007 format. Building floor plan CAD files on disk, will be made available via express mail after the receipt of payment of \$50.00 per building floor plan requested, \$300.00 minimum total fee. Contractor shall make the request for drawings in writing directly to the Architect, confirmation of the request and a release form will be forwarded to the Contractor to include a signed copy with payment prior to

release of files. Detail or riser diagram sheets or any other drawings other than floor or site plans, will not be made available to the Contractor.

D. Product Data

1. Material List: A material list with names of manufacturers, model numbers, and technical information on all equipment proposed.
2. Product technical information sheets for each principal component in the proposed system. Identify by arrow, circle or similar means products being proposed. Submittals consisting of unmodified catalog pages with no markings will be rejected.
3. Weight, dimensions and shipping splits.
4. Equipment operating and service (maintenance) clearances required around the equipment.

E. Shop Drawings

- F. Test Procedures: A written document detailing the proposed test procedures of the system shall be supplied. These procedures shall include all tests required by the equipment manufacturer and by this specification.

- G. Test Results Report: Test Results Report: The results of the execution of the testing procedure, including the items tested or inspected, the date, and by whom.

- H. Operating Sequences: Provide a complete written description of the Sequence of Operation of each of the systems including startup and recovery procedures

- I. Samples: when requested by Architect

- J. Operation and Maintenance (O&M) Manuals: Furnish composite "Systems Operation and Maintenance" manuals in indexed three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain, but not be limited to:

1. Operational procedures for the overall systems including the "Sequence of Operation".
2. Test procedures and test results.
3. Instruction for the proper operation and maintenance of the system.
4. Factory issued technical, installation, and maintenance manuals.
5. Factory issued operations and programming (software) manuals.
6. A replacement parts list complete with part numbers and name, address, and phone number of suppliers used by the Contractor. A spare parts list recommended for purchase by the District shall be included.
7. All portions of the material list and shop drawings which are not included in the foregoing.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Cameras: Sony
 - 2. Camera housing: Sony or Videolarm
 - 3. Equipment manufactured by Panasonic, Pelco, Bosch, Axis Elmo, Canon, JVC, Toshiba or any other manufacturers not listed above have been reviewed and are not considered equal or approved for use on this project.
- B. Source Limitations: Obtain materials and accessories from single source from single manufacturer.

2.02 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application. Contractor shall coordinate with District to integrate new cameras into the existing District surveillance system.
- B. Comply with CEC.

2.03 Remote IDF Equipment

- A. The Remote IDF location shall contain the following equipment to be installed in each of the existing campus IDF Rooms where camera connections originate. Components shall be mounted in the existing racks unless otherwise noted on the drawings.
 - 1. Additional network switches will be provided and installed by the District IT Department as required.
 - 2. Dell Power Edge 2850 servers will be provided and installed by the District.
- B. Cabling and data outlet shall conform to the requirements of Section 27 15 00.
- C. Provide all other items as detailed on the drawings.

2.04 Data/Camera Outlet Requirements

- A. Unshielded twisted pair data outlets shall be an RJ45 Enhanced performance type 8-position /
- B. 8 conductor modular jacks, and shall comply with proposed Category-6A performance requirements, single port, dual port or four port as noted on drawings. All outlets shall be wired in an EIA/TIA 568B configuration.
- C. Provide surface mount box and insert adapter for locations where cable must be terminated exposed directly to the weather and moisture. Provide CommScope TYCO/AMP Etherseal enclosures, faceplates and patch cords for direct exposure applications. Contractor will be responsible for identifying locations based on field conditions during construction. All enclosures and coverplates shall be gasketed and constructed of outdoor rated plastic. (No acceptable alternative.)

- D. Provide surface mount modular jack box for locations where cable is terminated in side junction box next to mount. Modular jack box can only be used for locations that will be protected from the weather and moisture.

2.05 Cable Requirements

- A. Provide one Category-6A, 4-pair, unshielded twisted pair (UTP) cable from the nearest IDF to each RJ45 data outlet port indicated on the drawings. Dual port outlets will require two such cables. Color for IP camera runs shall be red.
- B. Category 6A cables shall be copper wire, individually insulated and color coded.
- C. The cables shall be UL or ETL rated and UL verified in compliance with Category-6A.
- D. For all outdoor cable runs, jacket shall be outdoor rated PE with flooding compound.
- E. Provide a 1-pair, shielded twisted pair (STP) cable from the power supply/outlet at the IDF shown on the drawings to camera locations for power. Some exterior camera locations shall be provided with direct power to the pole. Cable shall be terminated on the power supply and in the enclosure at the camera location. Power supply location shown on the drawings. One pair conductors shall be used to transmit 24VAC to the camera. Cameras rated to use a maximum of 77 VA each. Power supplies may be combined or increased in total capacity to provide power to multiple camera locations within the manufacturer recommended distance limitation. Approved cables shall be West Penn Part #294, 295 and 296 for indoor applications and AQ225, AQ226, AQ227 for outdoor applications. Size of wire determined by manufacturer's recommended

2.06 Camera Enclosures

- A. Provide Sony outdoor camera housing dome system package for SNC-RX550N camera. See quantity of SNC-RX550N cameras for exact quantity of housings. Location of cameras and housings to be determined at time of installation. The outdoor housings shall be provided with the following minimum features:
 - 1. Vandal resistant outdoor housing
 - 2. Optically correct Polycarbonate Clear dome
 - 3. Cast aluminum top and trim ring
 - 4. Thermostatically controlled heater
 - 5. 24-hour fan operation
 - 6. 24VAC input into enclosure, AC@5V/DC 12V to camera
 - 7. Pendant mount, 1-1/2" NPT quick connect coupling
 - 8. Sony Model #UNI-ORL7C@ or equal by Videolarm (no other manufacturers will be considered equal).
- B. Provide Sony SNC-RX550N network camera (no approved equal). Cameras shall be used for outdoor coverage only. Coordinate which locations are to be this model camera with the Project Engineer and the District IT Manager prior to installation. Each camera shall be mounted in an outdoor rated enclosure.

2.07 Power Supplies

- A. Provide power supply for outdoor camera installation. Power supply shall be mounted directly to new or existing poles. See detail drawings for mounting requirements. Contractor shall provide all mounts, straps and adapters required to mount the power supply to the pole. Contractor shall field modify box and mounts as required to install power supply on the pole. Contractor shall seal all openings and drill holes to insure a weather-tight enclosure. Outdoor power supply shall have the following features:
1. Provide power supply for outdoor camera installation. Power supply shall be mounted directly to new or existing poles. See detail drawings for mounting requirements. Contractor shall provide all mounts, straps and adapters required to mount the power supply to the pole. Contractor shall field modify box and mounts as required to install power supply on the pole. Contractor shall seal all openings and drill holes to insure a weather-tight enclosure. Outdoor power supply shall have the following features:
 - a. Power supply shall have 115VAC input.
 - b. 24VAC output, total 96 VA power capacity
 - c. NEMA 4 rated enclosure
 - d. Videolarm Model #PS-24-96N or equal
 2. Provide power supply for outdoor/indoor camera installation. Power supply can be used to supply up to (2) camera locations (based on 77VA requirement per camera/housing). Power supply shall be mounted inside building next to existing IDF cabinet or near Cabinet. See detail drawings for mounting requirements. Contractor shall provide all mounts and adapters required to mount the power supply to the backboard or wall. Contractor shall field modify box and mounts as required. Install power supply at the IDF cabinet location. Indoor power supply shall have the following features:
 - a. Power supply shall have 115VAC input.
 - b. 24VAC output, total 175 VA power capacity
 - c. NEMA 1 rated enclosure
 - d. Videolarm Model #PS-24 or equal
 3. Provide power supply for outdoor/indoor camera installation. Power supply can be used to supply up to (6) camera locations (based on 77VA requirement per camera/housing). Power supply shall be mounted inside building next to existing IDF cabinet or near cabinet. See detail drawings for mounting requirements. Contractor shall provide all mounts and adapters required to mount the power supply to the backboard or wall. Contractor shall field modify box and mounts as required. Install power supply at the IDF cabinet location. Indoor power supply shall have the following features:
 - a. Power supply shall have 120VAC input
 - b. 24VAC output, total 480 VA power capacity
 - c. Sixteen 3A fused 24VAC outputs, total current capacity 20 Amps
 - d. NEMA 1 rated enclosure
 - e. Pelco Model #MCS16-20E or equal

2.08 Poles and Mounts

- A. Provide gooseneck style mount for outdoor pole, wall mount and indoor gym camera locations. Housings shall be pendant style and shall directly connect to the gooseneck mounts. See detail drawings for requirements. Provide all mounting adapters, strapping and anchoring bolts per manufacturer's recommendations and detail drawings. Route cabling through mount to camera enclosure. Contractor responsible for field modifications required to provide power and network connections to the camera.
 - 1. Provide Videolarm Model #WM20G (No approved equal)
- B. Provide parapet style mount for outdoor parapet, building and fascia mounted camera locations. Parapet mount shall have an extended pole for additional height. Housings shall be pendant style and shall directly connect to the parapet mounts. See detail drawings for requirements. Provide all mounting adapters, support plates and anchoring bolts per manufacturer's recommendations and detail drawings. Route cabling through mount to camera enclosure. Contractor responsible for field modifications required to provide power and network connections to the camera.
 - 1. Provide Videolarm Model #PRM30G (No approved equal)
- C. Provide flat roof style mount for outdoor roof or overhang area roof mounted camera locations. Roof mount shall have an extended pole for additional height. Housings shall be pendant style and shall directly connect to the parapet mounts. See detail drawings for requirements. Provide all mounting adapters, support plates and anchoring bolts per manufacturer's recommendations and detail drawings. Route cabling through mount to camera enclosure. Contractor responsible for field modifications required to provide power and network connections to the camera.
 - 1. Provide Videolarm Model #5RCW2000 (No approved equal)
- D. Mounting adapters shall be used as required depending on field conditions. Mounting adapters shall be used in conjunction with the camera housing mounts. Provide all support plates, strapping and anchoring bolts per manufacturer's recommendations and detail drawings. Contractor responsible for field modifications required to provide support and structural integrity for the mounts.
 - 1. Corner adapter plate – Videolarm Model #ACA2 (No approved equal)
 - 2. Pole adapter plate – Videolarm Model #APM3 (no approved equal)

2.09 Wireless Mesh Antenna System

- A. Provide a fully functional wireless antenna mesh system to provide Ethernet capability to cameras without a direct connection to the nearest IDF cabinet. Antennas shall be placed both inside buildings at IDF closet/Cabinet locations and on poles at the camera locations. Interior antenna locations shall connect to the new switch provided for the video surveillance system. Interior locations shall be provided with an external antenna located on the roof of the building. See drawings for location of antennas and roof mounting requirements. The wireless mesh system shall operate at 5.0 – 5.85 GHz range, depending on regulatory approvals.
- B. External wireless mesh nodes shall be installed on the poles where cameras are located. Refer to the drawings for quantity and location of wireless mesh nodes. Provide all mounting adapters, strapping and anchoring bolts per manufacturer's recommendations and detail drawings. Route cabling from wireless mesh node to the camera enclosure.

Some locations may have to be routed to the adjacent junction box to gain access to the mount. Contractor responsible for field modifications required to provide network connections to the camera housing. Provide exterior wireless mesh nodes with the following features:

1. Removable sun shield
2. Cast aluminum NEMA 4X / IP66 enclosure
3. Two antenna connectors
4. Weatherproof power connector

PART 3 - EXECUTION

3.01 CABLE INSTALLATION

- A. Refer to Cable Installation in - 27 15 00 COMMUNICATIONS HORIZONTAL CABLING

3.02 EQUIPMENT INSTALLATION

- A. The installation of the system shall be executed in accordance with the drawings and the equipment manufacturer's shop drawings. Should any variations in these requirements occur, the contractor shall notify the Architect before making any changes. It shall be the responsibility of the factory authorized distributor of the specified equipment to install the equipment and guarantee the system to operate as per plans and specifications.
 1. Mount with Security Screws
 - a. HEX Tamper Proof $\frac{3}{8}$ - 16 X1
 - b. Tamper Proof Torx 10-32 X3/4
- B. Furnish all equipment and labor to install a complete and operable system.
- C. 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.
- D. The contractor shall provide not less than eight (8) hours for instruction of personnel in the operation and maintenance of the systems. This instruction time shall be divided as directed by the District.

3.03 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 District.
- B. The contractor shall maintain a competent service organization and submit a service maintenance agreement to the District after the end of the guarantee period.

3.04 TESTING

- A. Provide all instruments for testing and demonstrating in the presence of the District's inspector that the frequency response is as stated in the factory data sheets.
- B. The District reserves the right to make independent tests of all equipment furnished to determine whether or not the equipment complies with the requirements specified herein and to accept or reject any or all of the equipment on the basis of the results thereby obtained.

END OF SECTION 282300

SECTION 28 31 11

FIRE DETECTION AND ALARM SYSTEM

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Provide a complete and operable system in accordance with the letter and intent of this specification section and with applicable Codes and Regulations as interpreted by the Authorities having jurisdiction. This Section is a performance specification and the detailed system design shall be done by the system manufacturer. The system shall comprise all necessary component parts to provide the functions and facilities described and to obtain the approvals requested. The system layout indicated on the drawings is only tentative and the types and quantities of system devices and raceways are minimums which shall be revised and augmented as required by the system to be provided.
- B. The entire system shall conform to applicable Codes. Equipment shall be U.L. listed, Factory Mutual listed and approved, approved, currently listed by the California State Fire Marshal, and shall conform to:
 - 1. California Code of Regulations,
 - a. Title 8 Industrial Relations
 - b. Title 19 Public Safety
 - c. Title 24 Building Standards Code
 - d. California Electrical Code (CEC)
 - e. California Fire Code (CFC)
 - f. California Building Code (CBC).
 - 2. Americans with Disabilities Act (ADA)
 - 3. NFPA 72-2016 National Fire Alarm Code
 - 4. Requirements of the La Mesa Fire Department.

1.02 ACCEPTABLE MANUFACTURERS

- A. New fire alarm systems shall be furnished by the following manufacture only, no substitutions are allowed.
 - 1. Gamewell – FCI

1.03 QUALIFICATIONS OF SYSTEM SUPPLIER

- A. Submit qualification of system supplier for approval based on the following minimum criteria:
 - 1. Successful experience in comparable installations which have been in operation for a period of not less than five years. Furnish a list of jobs and locations, with contact name and phone number, which fall in this category upon request.

2. Ability to provide emergency restoration service within 12 hours by factory certified personnel.
3. Installing contractor must have an office within San Diego County. That office must include 7/24 service department and must maintain spare inventory of all equipment used on this project.

1.04 DEFINITIONS

1.05 SUBMITTALS

A. Data sheets and shop drawings:

1. Submittals shall include State Fire Marshal Listing Sheets, including listing number with annual update and expiration date, for all system components. Submit installation shop drawings including scaled floor plans, complete point-to-point wiring schematics, list of all equipment with manufacturer's data sheets, the locations of each piece and device, battery and voltage drop calculations, and proposed conduit layout diagram, if conduit is required.
2. Data sheets are required for all system components, including but not limited to: control panels, batteries, battery chargers, signal initiating devices, audible alarms, visual alarms, annunciators, transponders, terminals, cabinets, wiring, and relays.
3. Fire Marshal approval of submittals is for permission to proceed and does not authorize design, products or installation not conforming to referenced codes and standards and this specification.
4. Fire Alarm system central equipment. All cabinets shall be surface mounted on the wall approximately where indicated on drawings. Submit a proposed wall elevation of the cabinet layouts, sketched to scale, with the shop drawing package. Owner's representative will review the shop drawings and provide the Contractor a drawing which will exactly locate the cabinets.

B. Operation and Maintenance Manuals: Manuals shall include all instructions necessary for proper operation and maintenance of the system, complete circuit diagrams, wiring and termination schedule for each circuit entering and/or leaving each piece of equipment and schematic diagrams of each major component, including a replacement parts list with part numbers, name, and telephone number of local supplier. Include all portions of the material list and shop drawings which are not included in the foregoing.

C. Certification: Furnish written certification from the fire alarm system manufacturer that the system is in compliance with all applicable Code requirements.

D. Training Agenda.

E. Testing Documentation.

F. Sequence of Operation: A description of the operation of the system with appropriate operator responses.

- G. Record Drawings: Documents shall include installation wiring, schematics, operation and maintenance manuals, complete replacement parts list. Drawings shall be reproducible type and shall be complete to facilitate trouble shooting and repair of the system.
- H. Spare Parts List: A list of recommended spare parts.

1.06 SYSTEM DESCRIPTION

- A. The system shall be a complete, electrically supervised proprietary style fire detection and evacuation system with microprocessor based local operating system having the following capabilities, features and capacities:
 - 1. Communication between the local panel and the central monitoring station.
 - 2. The local system shall provide status indicators the following functions:
 - a. Audible and visual evacuation alarm circuit zone control.

1.07 SYSTEM ZONING

- A. The basic system shall be addressable.

1.08 SYSTEM OPERATION

- A. Activation of any fire alarm initiating device shall cause the following actions and indications at the local control panel:
 - 1. An alarm received shall sound an Temporal Code 3 evacuation alarm throughout the facility, and;
 - a. Display the initiating device.
 - b. Perform all control functions as detailed elsewhere in this specification.
- B. Receipt of any trouble report, shall cause the following actions and indications:
 - 1. Display at the local fire alarm control panel LED display, the origin of the trouble condition report.
 - 2. Activate trouble audible and visual signals at the control panel and as indicated on the drawings.
 - a. Audible signals shall be able to be silenced from the fire alarm control panel by a trouble acknowledge switch.

Record within system history, the occurrence of the event, the time of occurrence and the device initiating the event.

1.09 TRAINING

- A. Submit a proposed training agenda for review. The final, approved training agenda shall be submitted 14 days prior to the final system acceptance test.
- B. Train three operators with personal, on job instruction provided by competent personnel representing the manufacturer.
 - 1. Provide each operator with complete, printed operating instructions in manual or handbook form.
 - 2. Provide two distinct training sessions, with minimum training time of four hours each. Sessions shall be scheduled to suit the District. The first session shall be scheduled about the time of the final acceptance test and the second sometime during the first six months of operations. District will provide the conference room.
- C. Training shall include all system operational functions needed. This shall include, but will not be limited to:
 - 1. Alarm acknowledgment.
 - 2. Interpretation of the scheme used to provide identifiers.
 - 3. System operation.
 - 4. System reset.
 - 5. Basic troubleshooting.
 - 6. Demonstrate that the system address assigned to each smoke detector corresponds correctly to device's field location.

1.10 SPECIAL TOOLS

- A. The Contractor shall supply as a part of the contract, three complete sets of any special tools or keys necessary for normal operation and maintenance of the system.

PART 2 - PRODUCTS

2.01 FIRE ALARM SYSTEM DESCRIPTION

- A. Intelligent reporting, networked, fully peer-to-peer, microprocessor-controlled fire detection system.
- B. Each Signal Line Circuit (SLC) and Appliance Notification Circuit (NAC): Limited to 75 percent of its total capacity during initial installation.
- C. Basic Performance:
 - 1. Network Communications Circuit Serving Network Nodes: Wired using single twisted non-shielded 2-conductor cable or connected using approved fiber optic cable

- between nodes in a modified Class B configuration with #16 AWG minimum conductors.
2. Signal Line Circuits Serving Addressable Devices: Wired Class B with #16 AWG minimum conductors.
 3. Initiating Device Circuit Serving Non-addressable Devices Connected to Addressable Monitor Modules: Wired Class B with the EOL resistor at the last device. Conductors shall be #16 AWG minimum.
 4. Appliance Notification Circuits Serving Strobes and Horns: Wired Class B with the EOL resistor at the last device. Conductors shall be #14 AWG minimum for Strobes and #16 AWG minimum for Horns.
 5. Alarm Signals Arriving at FACP: Not be lost following primary power failure until alarm signal is processed and recorded.
 6. Network Communications:
 - a. Communicated between panels and transponders on single pair of copper wires or fiber optic cables.
 7. Signaling Line Circuits:
 - a. Reside in remote transponders with associated audio zones.
 - b. Signal Line Circuit modules shall operate in peer-to-peer fashion with all other panels and transponders in system.
 - c. On loss of FACP, each transponder shall continue to communicate with remainder of system, including all Signal Line Circuit functions and audio messages located in all transponders.
 - d. Systems that provide a "Degraded" mode of operation upon loss of FACP shall not be acceptable.

2.02 FIRE ALARM SYSTEM OPERATIONAL DESCRIPTION

- A. When fire alarm condition is detected and reported by one of the system alarm initiating devices, the following functions shall immediately occur:
 1. System Alarm LEDs: Flash.
 2. Local Piezoelectric Signal in Control Panel: Sound at a pulse rate.
 3. 80-Character LCD Display: Indicated all information associated with fire alarm condition, including type of alarm point and its location within protected premises.
 4. Historical Log: Record information associated with fire alarm control panel condition, along with time and date of occurrence.
 5. System output programs assigned via control-by-event equations to be activated by particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.

2.03 FIRE ALARM CONTROL PANEL (FACP)

- A. Supply user interface, including LCD or touch-screen 1/4 VGA display, Intelligent Loop Interface Modules, manual switching, phone, and microphone inputs to the network. INCC shall consist of the following units and components:

1. Power Supply Module with batteries.
 2. 80-Character LCD Display.
 3. Intelligent Loop Main Board Interface.
 4. Intelligent Loop Supplemental Interface.
 5. Ethernet card for network.
 6. RS-485 Repeater.
 7. Auxiliary Switch Module.
- B. System Cabinet:
1. Surface or semi-flush mounted with texture finish. System Cabinet (B-, C-, or D-Size Cabinet) with associated inner door.
 2. Available in at least 3 sizes to best fit project configuration.
 3. Houses one or more Power Supply Modules, device zone loops, signal line circuits and other optional modules as specified.
 4. Construction: Dead-front steel construction with inner door to conceal internal circuitry and wiring.
 5. Wiring Gutter Space: A minimum of 1-inch wiring gutter space behind mounting plate.
 6. Wiring: Terminated on removable terminal blocks to allow field servicing of modules without disrupting system wiring.
- C. Power Supply Module: Use latest technologies to provide power to the FACP and incorporate the following features:
1. Power-saving switching technology using no step-down transformers.
 2. 9-amp continuous-rated output to supply up to all power necessary under normal and emergency conditions.
 3. Integral battery charger with capacity to charge up to 55 amp-hour batteries while under full load.
- D. Batteries:
1. Sufficient capacity to provide power for entire system upon loss of normal AC power for a period of 24 hours with 5 minutes of alarm signaling at end of this 24-hour period, as required by NFPA 72, Local Systems.
- E. Loop Interface modules:
1. Alarm Verification: Smoke detector alarm verification shall be standard option while allowing other devices such as manual stations and sprinkler flow to create immediate alarm. This feature shall be selectable for smoke sensors that are installed in environments prone to nuisance or unwanted alarms.
 2. Alarm Signals: All alarm signals shall be automatically latched or “locked in” at control panel until operated device is returned to normal and control panel is manually reset. When used for sprinkler flow, “SIGNAL SILENCE” switch may be bypassed, if required by Authority Having Jurisdiction.
 3. Electrically Supervised:

- a. Each SLC and NAC circuit shall be electrically supervised for opens, shorts, and ground faults. Occurrence of fault shall activate system trouble circuitry, but shall not interfere with proper operation of other circuits.
4. Analog Smoke Sensor Test: system software shall automatically test each analog smoke sensor a minimum of 3 times daily. Test shall be recognized functional test of each photocell (analog photoelectric sensors) and ionization chamber (analog ionization sensors) as required annually by NFPA 72. Failure of sensor shall activate system trouble circuitry, display "Test Failed" indication, and identify individual device that failed.
5. Signaling Line Circuits: Each module shall provide communication with analog/addressable (initiation/control) devices via 2 signaling line circuits. Each signaling line circuit shall be capable of being wired Class A or Class B. Circuits shall be capable of operating in NFPA Class A configuration when equipped with isolator modules between each module type device and isolator sensor bases. Each circuit shall communicate with a maximum of 99 analog sensors and 98 addressable monitor/control devices. Unique 40-character identifier shall be available for each device. Devices shall be of the Velocity series with capability to poll 10 devices at a time with a maximum polling time of 2 seconds when both SLCs are fully loaded.
6. Notification Appliance Circuits: 2 independent NAC circuits shall be provided, polarized and rated at 2 amperes DC per circuit, individually over current protected and supervised for opens, grounds and short circuits. They shall be capable of being wired Class B or Class A.
7. Alarm Dry Contacts: Provide alarm dry contacts (Form C) rated 2 amps at 30 VDC (resistive) and transfer whenever system supervisory condition occurs.
8. Trouble Dry Contacts: Provide trouble dry contacts (Form C) rated 2 amps at 30 VDC (resistive) and transfer whenever system trouble occurs.
- F. Control Panel: Provide in locations as shown on the drawings, fire alarm control panels to be solid state, modular and microprocessor based, password protected with the following features and capabilities:
 1. Initiating circuits shall be addressable.
- G. Two alarm supervised notification circuits controlled from any combination of the panel zones in a silence able or non-silence able manner to allow service as a waterflow indication circuit or supervisory circuit.
 1. Programmable to sound from any combination of zones in a steady, Temporal, march-time or zone coding.
 2. Capability of up to eight outputs, software configured to furnish supervised shutdown of air handlers upon detection of smoke in the HVAC system, selective offsite reporting of water flow, valve supervisory, other panel alarms, from any pre-determined combination of zones.

3. Power supply sized at 3.0 amperes to power the complete system including all relays, signals and alarm zones.
4. System standby batteries sized to power the system for a period of twenty four (24) hours with no external power applied and perform all reporting, shutdown and evacuation functions for five minutes at the end of that period.
5. Subsequent Alarm and Trouble with 24 hour reminder.
6. Alarm, Trouble, Supervisory History.
7. One Person Test.
8. Individual trouble and alarm lights for each initiation zone and system power on light.
9. System alarm light, alarm silence switch, trouble signal, trouble light, trouble signal silence switch, and system reset switch
10. Serial Remote Annunciators for alarm, supervisory and trouble by zone, supervised.
11. Drill Switch
12. Zone/Output Bypass

2.04 Code gage, hinged, locked cabinet with viewing window. MANUAL PULL STATIONS

- A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
 1. Manual Fire Alarm Stations: Non-code, non-break glass type, equipped with key lock so they may be tested without operating handle.
 2. Operated Station: Visually apparent, as operated, at a minimum distance of 100 feet from front or side.
 3. Stations shall be designed so after actual activation, they cannot be restored to normal except by key reset.
 4. Manual stations shall be construction of Lexan with clearly visible operating instructions provided on cover. The word FIRE shall appear on front of stations in raised letter, 1.75 inches or larger.
 5. Addressable manual stations shall, on command from control panel, send data to panel representing state of manual switch and addressable communication module status.
 6. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral] addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.

2.05 SYSTEM SMOKE DETECTORS

- A. General Requirements for System Smoke Detectors:
 1. Comply with UL 268; operating at 24-V dc, nominal.

2. Detectors shall be two-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
7. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.

B. Photoelectric Smoke Detectors

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.

C. Sensor range (normal, dirty, etc.).Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.
4. Duct Smoke Detectors Mounted above Ceiling or Otherwise Obstructed from Normal View: Provide with remote alarm indicator and remote test switch.
5. Each sensor shall have multiple levels of detection sensitivity.
6. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
7. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

2.06 HEAT DETECTORS

- A. General Requirements for Heat Detectors: Comply with UL 521.
 - 1. Temperature sensors shall test for and communicate the sensitivity range of the device.
- B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 degree F or a rate of rise that exceeds 15 degree F per minute unless otherwise indicated.
 - 1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
 - 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.07 NOTIFICATION APPLIANCES

- A. Strobes
 - 1. Compliance: ADA, CBC, and UL 1971.
 - 2. Maximum Pulse Duration: 0.2 second.
 - 3. Strobe Intensity: UL 1971.
 - 4. Flash Rate: UL 1971.
 - 5. Strobe Candela Rating: Determine by positioning selector switch on back of device.

2.08 REMOTE ANNUNCIATOR

- A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
 - 1. Mounting: Surface cabinet, NEMA 250, Type 1.
- B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.09 ADDRESSABLE INTERFACE DEVICE

- A. Addressable Dry Contact Monitor Modules
 - 1. Provide to connect 1 supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to 1 of the fire alarm control panel SLCs.
 - 2. Mount in standard deep electrical box.
 - 3. IDC Zone: Suitable for Style B operation.
- B. Addressable Control Module:
 - 1. Provide to supervise and control operation of 1 conventional NAC of compatible, 24-VDC powered, polarized audio/visual notification appliances or UL-listed polarized relays for fan shutdown and other auxiliary control functions.

2. Mount in standard 4-inch square, 2-1/8-inch deep electrical box or to surface-mounted back box.
3. Control Module NAC: Wire for Style Z or Style Y (Class B/B) with up to 1 amp of inductive signal or 2 amps of resistive signal operation. Relay coil shall be magnetically latched to reduce wiring connection requirements and to ensure 100 percent of all auxiliary relay or NACs shall be energized at same time on same pair of wires.
4. Audio/Visual Power: Provide by separate supervised power circuit from main fire alarm control panel or from supervised, UL-listed remote power supply.

C. Addressable Relay Module:

1. Available for HVAC control and other building functions. Relay shall have 2 Form C sets of contacts that operate in tandem and are rated for a minimum of 2.0 amps resistive or 1.0 amps inductive. Relay coil shall be magnetically latched to reduce wiring connection requirements and to ensure 100 percent of all auxiliary relay or NACs shall be energized at same time on same pair of wires.
2. Mount in standard 4-inch square, 2-1/8-inch deep electrical box or to surface-mounted back box.

2.010 DEVICE GUARDS

- A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.
1. Factory fabricated and furnished by device manufacturer.
 2. Finish: Paint, color white.

2.011 SPARE PARTS CABINET

- A. NEMA 1 cabinet with hinged lockable door and painted to match FACP, sized to accommodate the Maintenance Materials specified herein. Provide an engraved nameplate to read "FIRE ALARM SYSTEM SPARE PARTS CABINET".

2.012 NOTIFICATION DEVICES

- A. Evacuation Signaling Devices shall be furnished and installed as shown on the drawings, including the following features and capabilities:
1. Visual signals shall be installed in accordance with the requirements of U.L.1971 standard and NFPA 72. Where multiple visual signals are visible from any location, circuitry shall be incorporated for synchronization of the flash rate.
 2. UL 1971 Listed for Emergency Devices for the Hearing Impaired in all public mode installations.
 - a. Strobes shall meet UL 1971 and produce a flash rate of one (1) flash per second minimum over the listed input voltage of 24 VDC.
 3. All visual signals shall incorporate a Xenon flashtube enclosed in a rugged Lexan lens or equivalent with solid state circuitry.

4. The strobe intensity shall be rated per UL 1971 for 15, 75 or 110 Candela. Dual listing strobes of 15/75 intensity for UL1971/near-axis requirements shall be used where acceptable.
 5. The strobes shall be available for semi-flush or surface mounting and in conjunction with audible signals as required.
 6. For outdoor application in the private mode, the strobe shall be UL 1638 Listed and be rated for a temperature range of minus 32°F to 120°F.
- B. Audible evacuation signals shall be furnished and installed as shown on the drawings meeting the following requirements:
 - C. Notification appliance shall be electronic and use solid state components.
 - D. Each electronic signal shall provide eight (8) field selectable alarm tones. The tones shall consist of: tone, horn, march-time horn, code-3 horn, code-3 tone, slow whoop, siren, and hi/lo. Tone selection shall be by durable dip switch assembly and not clips or jumpers.
 - E. The device shall have provisions for standard reverse polarity type supervision and in/out field wiring using terminals that accept #12 to #18 AWG wiring.

2.013 OFF SITE DIGITAL ALARM COMMUNICATIONS

- A. The control panel shall contain integral facilities for off-site digital reporting via site telephone lines. Upon sensing an alarm condition within the panel, the communicator shall capture an operational telephone circuit and automatically dial the Central Receiving Station. Upon making contact with either the primary or secondary Central Receiving Station numbers using either the primary or secondary outgoing lines, the communicator shall establish its system identity and report the alarm condition. The communicator shall include the following features and capabilities:
- B. Integral fire alarm control panel mounting and listing under U.L. standard 864 with the control panel. All operating power shall be derived from the control panel primary and secondary power sources.
- C. Operating data base firmware stored in non-volatile memory and permanently installed on the system mother board. Entry into the programming mode shall be password protected to prevent unauthorized modification. The system shall be programmable by use of the software and passcode, on site or remotely using the data reporting telephone line connections.
 1. Changes in central station telephone numbers shall be programmable without the requirement for a site visit, from the central station.
 2. The communicator shall be capable of reporting up to four conditions present within the control panel, as follows:
 - a. Fire Alarm Condition.
 - b. System Trouble Condition.

PART 3 - EXECUTION

3.01 EQUIPMENT INSTALLATION

- A. Installation shall be in accordance with the CEC, NFPA 72, NFPA 101, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.
- B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.
 - 1. Connect new equipment to existing control panel in existing part of the building.
 - 2. Connect new equipment to existing monitoring equipment at the supervising station.
 - 3. Expand, modify, and supplement existing **[control]** **[monitoring]** equipment as necessary to extend existing **[control]** **[monitoring]** functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.
- C. Install wall-mounted equipment, with tops of cabinets not more than 78 inches above the finished floor.
- D. Manual Fire-Alarm Boxes:
 - 1. Install manual fire-alarm box in the normal path of egress within 60 inches of the exit doorway.
 - 2. Mount manual fire-alarm box on a background of a contrasting color.
 - 3. The operable part of manual fire-alarm box shall be between 42 inches and 48 inches above floor level. All devices shall be mounted at the same height unless otherwise indicated.
- E. Smoke- or Heat-Detector Spacing:
 - 1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
 - 2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
 - 3. HVAC: Locate detectors not closer than **[36 inches]** **[60 inches]** from air-supply diffuser or return-air opening.
 - 4. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.
- F. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.
- G. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches long shall be supported at both ends.
 - 1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.
- H. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

- I. Signaling line circuit wiring installed in underground conduits shall be a shielded twisted pair cable of water-blocked construction sized as per Fire Alarm manufacturer's requirements. West Penn Aquaseal or equal.

3.02 PATHWAYS

- A. Pathways shall be installed in EMT, minimum 1-inch conduit size.
- B. Exposed EMT shall be painted red enamel.

3.03 CONNECTIONS

3.04 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.

3.05 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.
- B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.06 TEST

- A. Provide the service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72.

3.07 FINAL INSPECTION/INSTRUCTION

- A. At the final inspection a factory trained representative of the manufacturer shall demonstrate that the systems function properly in every respect.
- B. Provide instruction 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.

END OF SECTION

SECTION 31 10 00

SITE CLEARING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes: Site clearing as specified herein.
- B. Related Sections:
 - 1. Section 31 10 00, Earth Moving.
 - 2. Section 33 44 19, Utility Storm Water Treatment.
 - 3. Section 01 50 00, Temporary Facilities and Controls.
 - 4. Section 32 91 00, Plantation Preparation for Tree Protection.
- C. Principal items of Work included herein:
 - 1. Site clearing and Grubbing.

1.02 REFERENCES

- A. Demolition shall be as per 2016 California Fire Code, Title 24, Part 9, Chapter 33.

1.03 PROJECT SITE CONDITIONS

- A. The Contractor shall be responsible to furnish and maintain all temporary barricades, warning lights, and other types of protection and to prevent accidental injury to the general public and personnel on the project.
- B. Existing improvements and existing active utility lines to remain (whether above or below ground) within the new construction area shall be properly and adequately protected from damage during the entire construction period. The Contractor shall be responsible to restore to their original condition any of these existing items that are damaged or disturbed.
- C. The Contractor shall be responsible to protect adjacent properties, roads, right of ways, utilities and other improvements above or below ground from damage in performing the work.
- D. Comply with applicable sections of the storm water pollution prevention plan, including but not limited to, erosion control, soil, waste and maintenance areas. Comply with the
- E. Salvaged Materials: Owner requires that a minimum of 50% (by weight) of all non-hazardous construction materials be recycled, composted and/or salvaged. Salvage shall conform to the following:
 - 1. Contractor shall submit salvage plan showing how all materials are to be sorted, salvaged and recycled. Plan must include all final destinations for each type of material.
 - 2. Salvaged items must be transported from site as they are removed, unless materials are to be reused on site.

3. Storage or sale of removed items on site will not be permitted, unless materials are to be reused on site.
4. Contractor shall provide certification for all salvaged materials. Certifications may take the form of receipts from recycling facilities, manufacturers, or any other legitimate form of certification. Certification types shall be outlined in salvage plan and approved by Owner.

PART 2 - PRODUCTS

(Not Applicable)

PART 3 - EXECUTION

3.01 EXECUTION

- A. Completely remove from the site (as required for construction) existing vegetation, trees, shrubs, bushes, debris, poles, posts, houses, sheds, garages, structures, footings, foundations, piers, curbs, walls, steps, slabs, pavement, substructures, underground utilities, cesspools, weir boxes, irrigation lines and appurtenances, septic tanks, fences, basement walls and slabs, tanks, manure, etc., unless otherwise indicated, including any other items necessary to construct the new work under this contract.
- B. Items removed shall be disposed of, off the property, in a legal manner.
- C. Trees and tree stumps unless indicated to remain, shall be removed, together with the bulk of the roots, to a minimum depth of 3 feet below the existing grade or finish grade, whichever is lower, within a radius of eight feet beyond perimeter of trunk at ground line. The resulting holes created by the tree removal shall be filled with clean earth and compacted to the same density as specified in Section 31 10 00, Earth Moving, for fills. Holes resulting from the tree removal shall not be backfilled until approved by the Inspector or other designated authority.
- D. During demolition operations, thoroughly wet down debris to allay the dust as necessary. Remove debris from the site as it accumulates. Accumulation of debris will not be permitted.
- E. Holes resulting from the removal of septic tanks, cesspools, or any other underground tanks or structures shall be backfilled in accordance with Section 31 10 00, Earth Moving and/or geotechnical report.
- F. Discussing existing vegetation into existing surface soils will not be permitted under any circumstances.
- G. Coordinate timing of demolition of existing temporary drainage structures with construction of new permanent drainage structures.

END OF SECTION

SECTION 31 20 00

EARTH MOVING

The Architect shall advise the District on the minimum number of soil borings that are required by code based on the size and configuration of the proposed structures and pavements for the purpose of soliciting Geotechnical services from a qualified Geotechnical engineer. In the event a project site is located near unusual geologic features, i.e., severe slopes, rock outcrops, etc., the Architect shall advise the District, in consultation with the Geotechnical engineer, how many additional borings they think would be needed in order to establish with some measure of confidence, that the subsurface conditions can be characterized as accurately as is reasonably possible. The Architect's assistance in this aspect of the project shall not convey any liability for the accuracy or completeness of the Geotechnical report. The Architect is acting in an advisory capacity only. The Geotechnical engineer shall at all times remain the sole design professional responsible for all Geotechnical recommendations.

When existing buildings prevent access to preferred boring locations, other methods should be considered such as slant drilling to obtain adequate coverage of the site.

Upon receipt of a Geotechnical report, the Architect shall review it and shall ask for clarification or additional information as they deem necessary.

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes: All required excavation, grading, preparation of subgrade for fills, proper placement of fills, including backfilling and compaction, watering, rolling, and compacting of fill material in place, and finish grading.
- B. Principal items of Work included herein:
 - 1. Excavation
 - 2. Filling
 - 3. Backfilling
 - 4. Geotechnical Engineer Inspection and Testing
 - 5. Grading
 - 6. Miscellaneous related work necessary for a complete job.
- C. Related Sections:
 - 1. Site Clearing, Section 31 10 00.
 - 2. Final subgrade preparation for asphalt paving, Section 32 12 16 – Asphalt Paving.
 - 3. Aggregate base beneath asphalt paving is specified under Section 32 12 16 – Asphalt Paving.
 - 4. Excavation and Fill, Section 31 23 00 for Utilities and Storm Drains.
 - 5. Utility Storm Water Treatment, Section 33 44 19 (Architect to Verify).
 - 6. Off-Site Improvements, division 2 (Architect to Verify)

7. Operations and Maintenance for Planting, Section 32 01 90.

1.02 PROJECT DATA

- A. Geotechnical Reports: The existing soil conditions at the site have been investigated, and a report of findings is on file at the Architect's office for review by the Bidders during the bidding period. This information is offered as supplemental information only, and no guarantee of existing soil or other conditions is intended. Architect to verify with Geotechnical Engineer for the desired wording for this paragraph.

Geotechnical / Geologic Investigation:

Title:

Report Date:

Prepared by:

Project No.

- B. The existing soil conditions at the site have been investigated and a report of the findings is on file at the District Office.

1.03 PERFORMANCE REQUIREMENTS

- A. All grading work shall be performed in accordance with 2013 CBC, Title 24, Part 2.
- B. The Grading Code of the County of San Diego, City of _____, and any special requirements of the permit.
- C. The Preliminary Geotechnical Investigation prepared by __ date__.
- D. Applicable General and Special Conditions of these specifications hereinafter set forth in full or by reference.
- E. A final Grading Report shall be submitted by the Geotechnical Engineer in accordance with 2013 CBC, Title 24, Part 2.

1.04 QUALITY CONTROL

- A. Testing and Inspections:
1. A Geotechnical Engineer, designated by the Owner, shall be engaged to perform continuous inspection of the placing and compacting of fills and backfills within the limits of grading of this project. Work shall be done in accordance with these specifications, the requirements of California Building Code, Chapters 18A and 33, and as recommended and approved by the Geotechnical Engineer. Costs for such inspection and tests shall be paid by the Owner. The Contractor shall be responsible for notifying the Geotechnical Engineer in advance so that he may be present to perform his services as needed.
 2. The Geotechnical Engineer shall also make an investigation of the fill material to establish the ability of the soil to sustain the vertical loads to be imposed on the fill by the proposed structure, and to confirm the expansion and other specified characteristics of the fill material.

3. The Geotechnical Engineer shall submit compaction reports to the Architect, Structural Engineer and the Civil Engineer at the completion of the Work, including test results and plot plans indicating the locations from which the tested samples of fill were taken. The Geotechnical Engineer shall keep the Architect and Civil Engineer informed of the progress of the grading work.

1.05 SITE CONDITIONS

- A. Protection:
 1. Protect adjacent property as required to prevent caving and sloughing of material onto adjacent property.
 2. Utility lines and structures shown shall be protected and treated as indicated. Where utilities not shown are encountered, report it to the Architect before proceeding with excavation. Remove inactive lines as directed, and plug the remaining ends. The Contractor shall bear the cost for all repairs to damaged utilities.
- B. Environmental Requirements: Contractor must comply with all requirements of the applicable County of San Diego and the City of _____ dust control ordinances. Comply with applicable sections of the Storm Water Pollution Prevention Plan, including but not limited to erosion control, material stockpiling, vehicle parking and maintenance areas.
 1. Construction operations and maintenance of equipment shall be performed only during the time period(s) and days allowed by local ordinance or government agency having jurisdiction.
 2. Earthwork operations shall be scheduled to complete the Work as quickly as possible to reduce the noise, dust and air pollution impacts.

PART 2 - PRODUCTS

2.01 FILL MATERIAL

- A. Additional earth material required to complete the work shall be provided by the Contractor at his expense.
- B. All earth imported products to the site shall meet or exceed United States Environmental Protection Agency (US EPA), Department of Toxic Substances (if applicable), and State of California regulations for clean fill. Proof of compliance is the responsibility of the Contractor.
- B. If this is a DTSC regulated site – contractor shall revise this paragraph to reflect the language agreed to in any PEAs, or other mitigation agreements.
- C. All imported material shall be approved by the Geotechnical Engineer prior to hauling on site. Contractor shall deliver samples to testing lab, labeled with location, project name, and date.

- D. Imported earth shall be of granular nature with sufficient binder to form a firm, stable, unyielding subgrade. Adobe or clay soils will not be acceptable. Earth imported shall be relatively non-expansive with an expansion index of less than 50, be clean and free from rubbish and debris and rock larger than 3 inches in maximum dimensions, not have sulfate content greater than 1,000 parts per million, and be subject to the approval of the Geotechnical Engineer. Imported fill material shall have an electrical resistivity exceeding 3,000 ohm cm. when saturated with distilled water, measured in accordance with the minimum resistivity procedure of California Test 643 or the soil resistivity box procedure shown in ASTM G57-06. Imported material to be used in areas to receive planting shall be approved by the Landscape Consultant of such quality as to support plant life.
- E. Bedding and backfill material for storm drain and utility lines shall be imported clean sand with a sand equivalent of at least 30 (California Test Method #217), and shall be placed in a minimum thickness of 6 inches for bedding and backfilled to 12 inches above the top of pipe.

2.02 SPECIAL REQUIREMENTS

- A. If imported soils are used within the upper 12 inches of areas to be planted, these soils shall conform to the requirements for planting soils as specified herein. Otherwise the upper 12 inches of all areas to be planted in the future shall consist of material obtained from the upper 12 inches of existing on-site soils.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Protect adjacent property and existing improvements and structures as necessary to prevent undermining, caving of cuts, and miscellaneous damage.
- B. Provide cribbing, sheeting, and shoring necessary to safely retain the earth banks and protect excavations and adjoining grades from caving and other damage resulting from excavating together with suitable forms of protection against bodily injury to personnel employed on the work and the general public. Be responsible for the design, installation, and maintenance of required cribbing and shoring and same shall meet the approval of the State Division of Industrial Safety and local governing agencies requirements.
- C. Utility lines and structures shown shall be protected and treated as indicated. Where work not shown is encountered, report it to the Architect before proceeding with excavation. Encase active lines in sleeves where they pass through concrete; remove inactive lines as directed, and plug the remaining ends. Bear the costs for repairs to damaged or broken utilities and any damages related thereto.
- D. An on-site, Pre-grading Meeting with the Architect, the General Contractor, and Geotechnical Engineer, Civil Engineer, Inspector and the Utility Line and Earthwork Subcontractor(s) is required prior to all grading related operations. The Pre-Job Conference will immediately follow the Pre-Construction Conference. Attendance is mandatory. City Inspection representatives and Utility Company representatives may also attend.
- E. Protect existing improvements and adjacent properties from storm damage and flood hazard originating on this project until final acceptance by the Owner. Prevent silt run-off from the limits of work in accordance with governmental requirements.

- F. A 6 foot high, temporary chain link fence and gates, (pair 26' wide, minimum) shall be erected prior to any grading operations at the construction limits perimeter. Coordinate the exact location with Architect and Inspector.

3.02 EXCAVATION

- A. Strip vegetation in accordance with Section 31 10 00 - Site Clearing. This material shall be disposed off site in a legal manner. All non-hazardous materials shall be composted, if possible. Contractor shall provide certification of composting location.
- B. Excavate unsuitable materials including compressible alluvium, expansive clay, organic material, contaminated soils, or other unsuitable materials. Any remaining dry, loose or soft materials should also be removed until a stable, unyielding condition under equipment loads is achieved. After making the recommended removals and prior to fill placement, the exposed ground surface shall be scarified to a depth of approximately 8 inches, brought to slightly above optimum moisture content, and compacted to at least 95% of the maximum dry density obtainable by the ASTM D1557-12 Standard Test Methods of Laboratory Compaction Characteristics of Soil Using Modified Effort. Surfaces on which fill is to be placed which are steeper than 5:1 (horizontal to vertical) should be benched so that the fill placement occurs on relatively level ground.

The observed on-site soils contain clay that appears to be potentially expansive. These soils are not considered suitable for foundation, floor slab or pavement support. If expansive clay soils are located within 3 feet of the bottom of foundations, floor slabs or other concrete walks or slabs, or within 18 inches of paving base course, they shall be removed and replaced with non-expansive compacted fill soils. The over-excavated area shall extend horizontally at least 10 feet beyond the building perimeter. The replacement fill material may consist of on-site or imported non-expansive soil with an Expansion Index of less than 50.

- C. Based on the proposed Grading Plans, a cut/fill transition will cross the building pad area. Over-excavation of the building pad area shall be performed to allow placement of at least 4 feet of non-expansive compacted fill beneath all foundations or slabs to 10 feet beyond the building area.

The building area is defined as outside face of any structure (i.e. wall, column, post) supporting or attached to overhead framing or roof structure, including masonry site walls over 5 feet high.

- D. Excavate to the depths, lines and grades indicated. Excavate sufficiently over-size to permit installation and removal of concrete forms and other required work.

Should soil of inadequate density and bearing capability be encountered at the elevations indicated on the drawings, or where new fill is to be placed upon existing loose fill material exposed by excavation, the excavation shall be carried to the depth required to attain soil of bearing quality as determined by the Geotechnical Engineer.

- E. Footing pads, if poured neatly, may be excavated to the net pad widths plus two-inches if approved by the Architect. Approval shall not be given until the completed excavation has been inspected.
- F. Should footing excavations exceed required dimensions or should sloughing occur, fill such extra space with concrete at no additional cost to the contract. If unsuitable material is found at the indicated depths, immediately notify the Architect.

- G. Notify the Inspector 48 hours before foundation excavations are ready for inspection.
- H. The bottoms of footings shall be free of loose material, debris, and water before concrete is placed.
- I. Cut banks shall be neatly trimmed to the required finish surface as the cut progresses, or the Contractor shall have the option of leaving the cuts full and finish grading by mechanical equipment which shall produce the finish surfaces as shown on the Drawings.
- J. Surplus earth not needed for filling and grading shall be disposed of in a legal manner off the site.

3.03 FILLING

- A. Fill material shall be placed in horizontal lifts not to exceed 6-inches in depth. Backfill placed in narrow restricted areas, such as along utility trenches, may be placed in 12-inch thick lifts. All fill material shall be free of rocks larger than 3 inches in maximum dimensions. Each layer shall be brought to slightly over optimum moisture content and, while still moist, shall be compacted by rolling and tamping. The rolling and/or tamping of each layer shall continue until the density thereof is not less than 95% of the maximum density obtainable using the ASTM D1557-12.
- B. Where fills are placed on existing slopes exceeding a slope of five horizontal to one vertical, the slopes shall be benched in accordance with the Geotechnical Engineer's requirements and local governing public agencies' requirements and compacted as herein specified before placing fill material on same so that fills shall be placed in horizontal layers as specified. Widths of benches shall be as directed by the Geotechnical Engineer.
- C. Rock encountered in the excavation on this site may, at the option of the Contractor, be broken up into pieces not larger than 3 inches in maximum dimension and be incorporated in the fill material if spread as directed by the Geotechnical Engineer. Otherwise, rocks larger than 3 inches in maximum dimension shall be removed from the site. Rocks and stones larger than 1 inch in maximum dimension will not be permitted within the top 12 inches of finished grade in non-paved areas. Contractor is responsible for examining geotechnical report to determine if rock or hard digging will be encountered and make provisions in the bid for removal of such materials. No additional payment will be made for rock removal or hard digging.
- D. Fill banks shall be graded full and compacted beyond the grade of the finish bank. After the banks have been filled, they shall be trimmed to the finish grades and limits shown on the Drawings. Slopes shall be inclined no steeper than 2:1 (horizontal to vertical).
- E. Imported fill soils shall have an Expansion Index of less than 50 based on ASTM D4829, and an R-Value of at least ____ for pavement areas.

The top 12 inches of the pavement subgrade shall be compacted to at least 95% of maximum dry density as determined by ASTM D1557-12.

- F. Retaining walls shall be backfilled with soil having an Expansive Index of 20 or less. The backfill area shall include the zone defined by a 1:1 sloping plane, back from the base of the wall. Retaining wall backfill should be compacted to at least 90% relative compaction based on ASTM D1557-12. Backfill should not be placed until walls have achieved adequate structural strength. Heavy compaction equipment which could cause distress to walls should not be used.

3.04 GRADING

- A. The entire area within the limits of grading as indicated on the Drawings shall be constructed to the lines, grades, elevations, slopes, and cross sections indicated on the Drawings. When the grading has been completed, the areas shall be rolled smooth with a steel tandem roller or equal. Should any low spots develop during the rolling operation, such spots shall be filled and rerolled smooth. Slopes, banks, and drainage depressions shall present a neat, uniform appearance on completion of the work. Provide temporary access roadways as needed during construction.
- B. It shall be the Contractor's full responsibility to take all measures necessary during grading to protect slope areas, both cut and fill, and adjacent properties from storm damage and flood hazard originating on this project until final acceptance by the Owner. It shall be the Contractor's responsibility to maintain completed slopes until all slopes are in satisfactory compliance with the job specifications.

3.05 COMPACTION

- A. All fills shall be compacted to at least 95 percent of maximum density obtainable using the ASTM D1557-12. Areas which are scarified shall be recompacted to these same requirements. The soil within the upper 12 inches of pavement subgrade should be compacted to at least 95% relative compaction based on ASTM D1557-12.
- B. Compaction by flooding is expressly prohibited.

3.06 CRIBBING AND SHORING

- A. Provide cribbing, sheeting, and shoring necessary to safely retain the earth banks and protect excavations and adjoining grades from caving and other damage resulting from excavating, together with suitable forms of protection against bodily injury to personnel employed on the work and the general public.

The responsibility for the design, installation, and maintenance of required cribbing and shoring shall be entirely that of the Contractor and shall be in accordance with the current requirements of CAL-OSHA, the Industrial Accident Commission of the State of California, and all other public agencies having jurisdiction.

3.07 DUST CONTROL

- A. During grading operations, water shall be applied to the surfaces in the working area at frequent intervals and in sufficient quantities to lay the dust and for proper compaction. No other method will be permitted.

3.08 GRADING TOLERANCES AND SUBGRADE PROVISIONS

- A. Rough grading shall consist of grading to the finish grade elevations indicated on the grading plans, including, but not limited to, excavation, scarification, filling, compacting, importing, exporting, preparation of sub-grades, building pads, slopes, berms, ramps, etc. Rough grading shall also include grading to and providing the finished subgrade surface for all asphalt and cement concrete areas, building, ramps, gutters, etc. Rough grading shall be performed within a tolerance of 1/10 of a foot of the elevations indicated on the Drawings (including subgrade elevations) however, this is not to be construed as being permissible to leave the entire area 1/10 of a foot consistently high or low by that amount.

3.09 CLEANING

- A. Upon completion of work in this Section, remove rubbish, trash, and debris resulting from operations. Remove unused equipment and implements of service, and leave entire area involved in a neat, clean, and acceptable condition.

END OF SECTION

SECTION 31 22 19

FINISH GRADING

PART 1 - GENERAL

1.01 SUMMARY

- A. Provide materials, labor and equipment necessary for the completion of finish grading as indicated on the Drawings and specified herein.
- B. Related Sections:
 - 1. Earth Moving, Section 31 20 00.
 - 2. Excavation and Fill, Section 31 23 00, for Utilities and Storm Drains.
 - 3. Operation and Maintenance of Planting, Section 32 01 90, for Landscaping Planting and Maintenance.
 - 4. Utility Storm Water Treatment, Section 33 44 19, for Storm Water Pollution Protection.
 - 5. Temporary Tree and Plan Protection, Section 01 56 39.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Refer to Section 31 20 00 – Earth Moving, for material for fill and planting areas, also Section 32 01 90.

PART 3 - EXECUTION

3.01 PREPARATION FOR FINISH GRADING

- A. The entire area within the limits of grading as indicated on the Drawings shall be constructed to the lines, grades, elevations, slopes, and cross sections indicated on the Drawings. When the grading has been completed, the areas shall be rolled smooth with a steel tandem roller or equal.

Should low spots develop during the rolling operation, such spots shall be filled and re-rolled smooth. Slopes, banks, and drainage depressions shall present a neat, uniform appearance on completion of the work.
- B. Fine grade to bring areas to required lines and grades. The subgrade elevation within the building area for slabs on grade (without a base course) shall be within 0.50- inch along a 10 foot straight edge.
- C. Slope finish grades to drain surface water away from buildings, walks, paving, and other structures. Generally, grade with uniform slope between points where elevations are given, or between such points and existing grades. Excavate and grade swales to provide drainage away from and around buildings.

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- D. Areas to Receive Paving or Surfacing: Review plans and details for each area. See plans for paving and base course thickness. Review Drawings for sitework details.
- E. Areas to Receive Topsoil and/or Planting: Where not otherwise indicated, areas outside of buildings shall be given uniform slopes between points for which finish grades are shown, or between such points and existing established grade, except that vertical curves or roundings shall be provided at abrupt changes in slope.
- F. Rocks or cobbles larger than 1 inch in diameter shall not be placed in the upper 12-inches of planting area fill, and rocks or cobbles larger than 3/4-inch shall not appear on the finish graded surface.
- G. Surplus or Imported Material:
 - 1. Surplus material not needed for filling shall be removed from the site in a legal manner.
 - 2. Provide additional earth material per Section 31 20 00, Earth Moving.
- H. Preparation for Fills:
 - 1. Prior to placing fills, the existing surface shall be scarified and recompact to at least 95 percent maximum dry density per the ASTM D1557-12 procedure.

3.02 FIELD QUALITY CONTROL

- A. Compaction of soils performed on this project shall be at least 90 percent of the maximum dry density per the ASTM D1557-09 procedure. New turf and planted areas shall be compacted to 85 percent. Aggregate bases shall be compacted to 95 percent.
- B. All layout shall be performed by a qualified licensed civil engineer or surveyor.

END OF SECTION

SECTION 31 23 00

EXCAVATION AND FILL FOR STORM DRAINS AND UTILITIES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes: Excavation and backfill for utilities and storm drains as indicated on the Drawings and specified herein, including off-site work.

1.02 REFERENCE STANDARDS

- A. Title 24, California Code of Regulations, California Building Code, 2013, and County of San Diego Grading Ordinance.
- B. CAL-OSHA requirements.
- C. Standard Drawings of the County of San Diego.
- D. The Standard Specifications for Public Works Construction, current edition.

1.03 PERFORMANCE REQUIREMENTS

- A. Be fully responsible to furnish and maintain temporary barricades, warning lights, and other types of protection and to prevent accidental injury to the general public and personnel employed on the project.
- B. Provide adequate cribbing, sheathing, and shoring as necessary to safely retain the earth sides of excavations and trenches from caving and other damage resulting from excavating, together with suitable forms of protection against property damage and bodily injury to personnel employed on the work and the general public. The Contractor shall be responsible for the design, for installation, and maintenance of required cribbing and shoring.
- C. Protect new and existing utilities from damage during the course of installation, and repair work so damaged at no additional cost to the Owner.

1.04 PERMITS

- A. Obtain permits, fees, or bonds required for the work performed under this section. Owner will pay the cost of permanent construction permits. Bonds and encroachment permits shall be paid by the Contractor.

1.05 INSPECTION AND TESTING

- A. A Testing Laboratory designated by the Owner and approved by the Division of the State Architect, will be engaged to perform tests and inspections of the placing and compacting of backfills. Work shall be done in accordance with these Specifications. Costs for inspection and conforming tests shall be paid by the Owner.
- B. Contractor shall be responsible for notifying the Testing Laboratory at least 48 hours in advance of the time where testing services are needed.

- C. The Testing Laboratory shall submit compaction reports to the Architect, and shall notify the Architect immediately of test failures.
- D. Refer to Section 01 45 23 - Testing and Inspecting Services for additional requirements.

1.06 QUALITY ASSURANCE

- A. Underground utility lines shall not be covered by backfill until "As-Built" elevations and dimensions have been recorded on Record Drawings, and until the utility lines have been inspected and satisfactorily tested. As-built elevations shall be provided by the contractor's licensed surveyor. See Section 01 71 23, Field Engineering.
- B. Before commencing backfilling of utilities, take photo-graphs showing relationship of below ground utilities to structure(s) or other physical reference point. Provide three-ring binder containing 5" x 7" prints of photos, and negatives categorized by locations and indicating utilities shown.

Number each photograph and provide a site plan with a location shown for each photo. The location of the number shall correlate with the place the photo was taken and the direction the camera was pointed.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Bedding sand shall be as defined by Standard Specifications for Public Works Construction, current Edition (Green Book) Section 202.2, and shall be free of expansive material and organic matter. Bedding material for utility lines and storm drains outside the property lines shall be as required by the agency having jurisdiction.
- B. Backfill material shall be as required in Section 31 20 00 – Earth Moving. All requirements specified in that section for fill, backfill, import, and planting soil shall apply to material used for utility and storm drain trenches.
- C. Engineer to enter any specific requirements from Geotechnical Report for Project.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Underground Utilities: Carefully lay out the route of each underground utility prior to trenching. Coordinate the work of various trades to avoid conflicts.
- B. Clearances: Maintain required horizontal and vertical clearances from structural footings for utility trenches running parallel to footings. In the event of conflict the Architect shall be notified.
- C. Saw cut and remove any pavement necessary for installation of all utilities shown on the plans, including architectural, landscape, civil, plumbing, electrical and low voltage. Provide new pavement to match the existing pavement removed, if not specifically shown differently on the plans. In all cases, the worst case rules.

3.02 TRENCHING

- A. Excavate trenches for utilities to the required lines, grades and elevations indicated on the drawings and as specified. Hand trim changes in direction and bottoms of trenches. Accurately shape and thoroughly compact trench bottom to required grade. Keep trenches clean until installed work has been approved.
- B. Trench Dimensions: For adequate pipe clearances and dimensions provide the following minimum dimensions unless otherwise required by the drawings, specifications, utility company regulations, codes, or manufacturers recommendations.
 - 1. Pipe Depths:
 - a. Sewer: Minimum 30 inches plus pipe diameter plus 4 inch bedding.
 - b. Storm Drain: Minimum 24 inches plus pipe diameter plus 4 inch bedding.
 - c. Gas: 30 inches plus pipe diameter plus 4-inch bedding.
 - d. Domestic Water:
 - PVC: 36 inches plus pipe diameter plus 4 inch bedding.
 - Other: 36 inches plus pipe diameter plus 4 inch bedding.
 - e. Irrigation Water:
 - 1) 3 inch diameter or less: 18 inches plus pipe diameter plus 2 inch bedding.
 - 2) 4 inch diameter or more: Same as domestic water.
 - 2. Trench Widths:
 - a. Sewer: 6 inches plus pipe diameter min.
 - b. Storm Drain: 6 inches plus pipe diameter, min..
 - c. Gas: 8 inches plus pipe diameter, min.
 - d. Domestic Water: 8 inches plus pipe diameter, min.
 - e. Joint Trench: Joint trenches are allowed in accordance with the current edition of the Greenbook, Standard Specifications for Public Works Construction and local jurisdiction standards. Contractor shall submit a trench plan to the project engineer for approval prior to proceeding with joint trenches not shown on the plans. Contractor cannot assume joint trenches are allowed during bidding, unless joint trenches are shown on the plans.

3.03 BEDDING

- A. Lay pipe in compacted bedding sand of thickness as specified above and backfill with bedding sand to a height of 12 inches above the top of the pipe. Place sand in 6 inch layers, compacting each lift to a minimum relative density of 90 percent. Compaction by flooding is prohibited.
- B. For irrigation piping laying requirements refer to Section 32 84 00 – Planting Irrigation.

3.04 BACKFILLING

- A. Backfill with approved native or import soils as specified in Article 2.01 herein.
- B. Spread, water, and mix backfill to obtain optimum moisture content. Compact by mechanical means in 6 inch lifts to a minimum relative density of ninety percent (95%) in accordance with ASTM D1557-12, after the first 12-inches.
- C. Continue backfilling as required to secure final grade elevations.
- D. Backfill existing utilities which may be uncovered during course of construction in the same manner as specified herein for new utilities.
- E. Coordinate backfilling with representative of Owner's Testing Laboratory.

3.05 CLEANUP

- A. Transport unsuitable material to a legal off-site disposal area.

END OF SECTION

SECTION 31 31 16

TERMITE CONTROL

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes: Termite control as indicated on the Drawings and specified herein.
- B. Related Sections:
 - 1. Cast-in-Place Concrete, Section 03 30 00.

1.02 SUBMITTALS

- A. Submittals shall be made in accordance with Section 01 33 00.
- B. Submit plan showing how application of Termite Control will confirm to the EPA's Integrated Pest Management Guidelines and the School's guidelines for Pest Control Management.

1.03 GUARANTEE

- A. Upon completion of the termite control work, and as a condition of final acceptance, submit a written guarantee to the Owner providing:
 - 1. That the application was made at the concentration, rates and methods in compliance with this specification.
 - 2. That the effectiveness of the treatment is guaranteed for a term of five (5) years.
 - 3. That evidence of subterranean termite activity or damage to the structure resulting from such activity within the guarantee period will be treated and repaired at no cost to the Owner.
 - 4. Guarantee shall comply with Section 01 78 30 – Warranties, Guarantees, and Bonds.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Apply one of the following chemicals as a water emulsion at not less than the concentration and volumes designated on chemical container label. Strictly follow chemical mixing, use in handling, directions and environmental cautions stated on product label:
 - 1. Chlorpyrifos
 - 2. Permethrin
 - 3. Cypermethrin
 - 4. Fenvalerate

- B. If combination of these toxicants is used, at least one must be applied at not less than the percentage designated.
- C. Proprietary formulas may be used providing they contain one or more of the above named chemicals in at least the concentration specified and is registered with the Environmental Protection Agency and the California Department of Food and Agriculture, and the label sets forth the names and percents of active ingredients of the formula. A copy of this registration and formula shall be submitted for review.
- D. The materials shall be delivered to the project site in the original sealed and labeled containers of the manufacturer.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Sufficient notice shall be given to permit application to be made at least twelve (12) hours prior to concrete placement. To avoid surface flow of the toxicant from the application site, treatment shall not be made when soil or fill is excessively wet. Apply only after preparation for concrete placement has been completed. There shall be no disturbance of treated areas.
- B. Horizontal Barriers: Make application under the entire surface of slabs-on-grade (except sidewalks) as on overall treatment of not less than 100 gallons (over ABC fill) or 150 gallons (over crushed rock fill) per 1,000 square feet. Treat sidewalks, entrance platforms and other slabs abutting the building for an area not less than three (3) feet wide adjacent to the building.
- C. Vertical Barriers: Apply at the rate of four (4) gallons per 10 linear feet as follows:
 - 1. Along the interior side of foundation walls.
 - 2. Along the exterior side of foundation walls where floors, entrances, sidewalks, etc., will abut the building.
 - 3. Along expansion or cold joints.
 - 4. Wherever slab will be penetrated by construction features.

3.02 PROTECTION

- A. Safety Precautions: Notify on-site work persons that a toxic material is going to be applied and that work in or adjacent to the involved area may be hazardous to their health.

END OF SECTION

SECTION 32 12 16

ASP CONC PAVING

PART 1 - GENERAL

All applicable portions of Division 1, including the drawings and general provisions of the contract, the general and supplementary conditions and Division 1 specification sections which apply to work of this section as if printed herein.

1.1 WORK INCLUDED:

1.1.1 Work includes asphaltic concrete paving over aggregate base.

1.2 RELATED WORK:

1.2.1 Related Work Specified Elsewhere:

1.2.1.1 Section 311000 - Site Clearing: Removal of existing asphaltic concrete paving.

1.2.1.2 Section 312200 - Earthwork: Preparation and compaction of subgrade.

1.3 QUALITY ASSURANCE:

1.3.1 Qualifications of Asphalt Concrete Producer: Bulk asphaltic concrete producer regularly engaged in production of hot-mix, hot-laid asphalt concrete.

1.3.2 Regulatory Requirements:

1.3.2.1 In addition to complying with the applicable codes and regulations of governmental agencies having jurisdiction, comply with the applicable requirements of CALTRANS Standard Specifications for Public Works Construction.

1.3.2.2 Where the provisions of applicable codes, regulations and standards conflict with the requirements of this specifications, comply with the more stringent provisions.

1.3.3 Source Quality Control:

1.3.3.1 Tests: Materials for which physical characteristics have been stipulated shall have had such characteristics independently confirmed by laboratory tests employing industry-recognized procedures. Both the laboratory performing the tests and the test methods employed will be subject to the approval of the Architect.

1.3.3.2 Certification: Furnish certification, in written form, from the asphaltic concrete producer, confirming the conformance of the following with the requirements of this specification:

1.3.3.2.1 Materials proposed for incorporation into the Work.

1.3.3.2.2 Asphaltic concrete mix design formulae.

1.4 SUBMITTALS:

- 1.4.1 Product Data: For proprietary products, submit complete manufacturer's description literature and specifications in accordance with the provisions of Section 013300.
 - 1.4.1.1 Materials List: Submit complete lists of materials proposed for use, giving the manufacturer's name, catalog number, and catalog cut for each item where applicable.
 - 1.4.1.2 Manufacturer's Recommendations: Submit the manufacturer's current recommended methods of installation, including relevant limitations, safety and environmental cautions, and application rates.
- 1.4.2 Test Reports: When and as directed by the Architect and/or Owner, submit certified laboratory test reports confirming physical characteristics of materials used in the performance of the Work of this Section.
- 1.4.3 Mixes: Submit asphaltic concrete mix design formulae.

1.5 PROJECT CONDITIONS:

- 1.5.1 Weather Limitations:
 - 1.5.1.1 Apply bituminous prime and tack coats only when the ambient temperature in the shade is above 50 degrees F.
 - 1.5.1.2 Do not apply when the base surface is wet or contains an excess of moisture which would prevent uniform distribution and the required penetration.
 - 1.5.1.3 Construct asphalt concrete surface course only when atmospheric temperature is above 40 degrees F, when the underlying base is dry, and when weather is not rainy.
- 1.5.2 Grade Control: Establish and maintain the required lines and grades, including crown and cross-slope, for each course during construction operations.
- 1.5.3 Traffic Control: Maintain vehicular and pedestrian traffic during paving operations, as required for other construction activities.

PART 2 - PRODUCTS

- 2.1 AGGREGATES: Use materials and gradations that have performed satisfactorily in previous installations.
 - 2.1.1 Base Course Aggregate: Class 2 Aggregate Base mineral aggregate, 3/4 inch maximum size, as specified in CALTRANS Standard Specifications
 - 2.1.1.1 Recycled asphalt paving may be used as base course aggregate, subject to complying with CALTRANS Standard Specifications.
 - 2.1.2 Asphalt Aggregate: Type B Aggregate, as specified in CALTRANS Standard Specifications.
 - 2.1.2.1 3/4 inch maximum size for base course.

2.1.2.2 1/2 inch maximum size for surface course.

2.2 ASPHALT MATERIALS

- 2.2.1 Asphalt Cement: Steam Refined, penetration-graded material. PG 64-10 conforming to CALTRANS Standard Specifications.
- 2.2.2 Prime Coat: Asphalt prime coat conforming to CALTRANS Standard Specifications.
- 2.2.3 Tack Coat: Asphalt tack coat conforming to CALTRANS Standard Specifications.
- 2.2.4 Seal Coat: Emulsified asphalt with a minimum 2 percent – 3 percent latex or copolymer added with 2-4 lbs of grade No. 30 silica sand added per gallon and mechanically agitated.

2.3 ASPHALT MIXES

- 2.3.1 Hot-Mix Asphalt: Provide dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction and designed according to procedures in AI's "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types."

2.3.1.1 Comply with CALTRANS Standard Specifications.

2.3.1.2 Provide mixes complying with the composition, grading, and tolerance requirements of ASTM D 3515 for the following nominal, maximum aggregate sizes:

2.3.1.2.1 Surface Course: 1/2 inch maximum.

2.3.1.2.2 Base Course: 3/4 inch maximum

2.4 CRACK SEALER

- 2.4.1 Rubberized joint sealant complying with Federal Standards ASTM D5329 Parking Lot Crack Sealer.

2.5 PAVEMENT MARKING PAINT:

- 2.5.1 Latex, water-base emulsion, ready-mixed, complying with FS TT-P-1952.
- 2.5.2 Color: As indicated.

2.6 ASPHALT-AGGREGATE MIXTURES:

- 2.6.1 Job-mix Criteria:

2.6.1.1 Provide job-mix formulas for each required asphalt-aggregate mixture.

2.6.1.2 Establish a single percentage of aggregate passing each required sieve size, a single percentage of asphalt cement to be added to aggregate, and a single temperature at which asphalt concrete is to be produced.

2.6.1.3 Comply with the mix requirements of Caltrans Standard Specifications.

2.6.1.4 Maintain material quantities within allowable tolerances of the governing standards.

2.7 HEADERS AND STAKES:

2.7.1 Provide 2 inches by 6 inches redwood header adjacent to asphalt paving as shown on plans. Redwood header shall be placed along the entire length where asphalt paving butts to all turf areas, planter areas, modular buildings or areas where concrete walkways do not occur.

2.8 HERBICIDE:

2.8.1 Provide a commercial chemical for weed control, registered by Environmental Protection Agency (EPA). Provide liquid, or wettable powder form.

PART 3 - EXECUTION

3.1 PREPARATION:

3.1.1 Aggregate Base Course:

3.1.1.1 Check subgrade for conformity with elevations and section immediately before placing aggregate base material.

3.1.1.2 Place aggregate base material in compacted layers not more than 4 inches thick. Compaction shall be obtained by use of an approved power roller weighing not less than 10 tons.

3.1.1.3 Spread, shape, and compact all aggregate base material deposited on the subgrade during the same day.

3.1.1.4 Compact aggregate base course material to not less than 95 percent of maximum density: ASTM D 1557, Method D.

3.1.1.5 Test density of compacted aggregate base course: ASTM D 2167.

3.1.1.6 Conduct one (1) test for each 2,500 square yards of in-place material, but in no case no less than one daily for each layer.

3.1.1.7 Treat all sub-base with weed killer in accordance with manufacturer's instructions. Take extreme precaution to confine weed poison to area covered with asphaltic concrete, and provide all necessary protection to prevent injury or damage to life or property.

3.1.2 Prime Coat:

- 3.1.2.1 Uniformly apply at rate of 0.20 to 0.25 gallons per square yard over compacted and cleaned sub-base surface.
- 3.1.2.2 Apply enough material to penetrate and seal, but not flood the surface.
- 3.1.2.3 Allow to cure and dry as long as required to attain penetration and evaporation of volatile, and in no case less than 24 hours unless otherwise acceptable to the Architect.
- 3.1.2.4 Blot excess asphalt with just enough sand to prevent pick-up under traffic. Remove loose sand before paving.

3.1.3 Tack Coat:

- 3.1.3.1 Dilute material with equal parts of water and apply to contact surfaces of previously constructed asphalt concrete or Portland cement concrete and similar surfaces.
- 3.1.3.2 Apply at rate of 0.05 to 0.15 gallons per square yard of surface.
- 3.1.3.3 Apply tack coat by brush to contact surfaces of curbs, gutters, manholes, and other structures projecting into or abutting asphalt concrete pavement.
- 3.1.3.4 Allow surfaces to dry until material is at condition of tackiness to receive pavement.

3.2 PREPARING THE MIXTURE:

- 3.2.1 Comply with ASTM D 995 for material storage, control, and mixing, and for plant equipment and operation.
- 3.2.2 Heating:
 - 3.2.2.1 Heat the asphalt cement at the mixing plant to viscosity at which it can be uniformly distributed throughout mixture.
 - 3.2.2.2 Use lowest possible temperature to suit temperature-viscosity characteristics of asphalt.
 - 3.2.2.3 Do not exceed 350 degrees F.
- 3.2.3 Aggregate:
 - 3.2.3.1 Deliver dry aggregate to mixer at recommended temperature to suit penetration grade and viscosity characteristics of asphalt cement, ambient temperature, and workability of mixture.
 - 3.2.3.2 Accurately weigh or measure dry aggregates and weigh or meter asphalt cement to comply with job-mix formula requirements.

3.2.4 Joints:

3.2.4.1 Carefully make joints between old and new pavements, or between successive days' work, to ensure a continuous bond between adjoining work.

3.2.4.2 Clean contact surfaces free of sand, dirt, or other objectionable material and apply tack coat.

3.3 COMPACTING THE MIX:

3.3.1 Provide sufficient power rollers to obtain the required pavement density. Minimum 10 ton power roller.

3.3.2 Begin rolling operations as soon after placing when the mixture will bear weight of roller without excessive displacement.

3.3.3 Do not permit heavy equipment, including rollers to stand on finished surface before it has thoroughly cooled or set.

3.3.4 Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.

3.3.5 Breakdown Rolling: Accomplish breakdown or initial rolling immediately following rolling of transverse and longitudinal joints and outside edge.

3.3.6 Second Rolling: Follow breakdown rolling as soon as possible, while mixture is hot and in condition for compaction. Continue second rolling until mixture has been thoroughly compacted.

3.3.7 Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained specified density.

3.3.8 Patching:

3.3.8.1 Remove and replace defective areas.

3.3.8.2 Cut-out and fill with fresh, hot asphalt concrete.

3.3.8.3 Compact by rolling to specified surface density and smoothness.

3.3.8.4 Remove deficient areas for full depth of course.

3.3.8.5 Cut sides perpendicular and parallel to direction of traffic with edges vertical.

3.3.8.6 Apply tack coat to exposed surfaces before placing new asphalt concrete mixture.

3.4 FIELD QUALITY CONTROL:

3.4.1 General: In addition to other specified conditions, comply with following minimum requirements:

- 3.4.1.1 Test in-place asphalt concrete courses for compliance with requirements for density, thickness and surface smoothness.
- 3.4.1.2 Provide final surfaces of uniform texture, conforming to required grades and cross-sections.
- 3.4.2 Thickness: In-place compacted thicknesses shall conform to the dimensions shown on the Drawings. Variation from indicated thicknesses shall not exceed plus or minus 1/2 inch. If thickness is not shown, minimum thickness shall be 3 inches of asphalt paving over 6 inches of granular base and at bus drop-off areas and fire lanes, provide 4 inches of asphalt paving over 10 inches of granular base. Actual structural sections shall be determined after an "R" value test has been conducted by a qualified geotechnical engineer on the prepared sub-base material.
- 3.4.3 Surface Smoothness:
 - 3.4.3.1 Test finished surface of each asphalt concrete course for smoothness, using a 10-foot straightedge applied parallel to and at right angles to centerline of paved areas.
 - 3.4.3.2 Surfaces will not be acceptable if exceeding the following:
 - 3.4.3.2.1 Base Course: 1/4 inch in 10 feet.
 - 3.4.3.2.2 Surface Course: 3/16 inch in 10 feet.
- 3.4.4 Asphalt Concrete Intersection to Concrete Control:
 - 3.4.4.1 All asphalt concrete paved areas that butt to or intersect to all concrete, concrete gutters, concrete swales and concrete walkways, the asphalt concrete shall be a minimum 1/4 inch to maximum 1/2 inches above the adjacent concrete surface after applying finish rolling. In no case shall the asphalt concrete paving, after final rolling, at the intersection of any concrete surfaces, shall be below the finish concrete paved surface(s) unless specifically detailed on the drawings.
- 3.5 FLOOD TEST:
 - 3.5.1 Flood Test: Before applying a seal coat or striping, a water test shall be made in the presence of the Inspector of Record. The flooding shall be done by water tank truck. All depressions, where water ponds to a depth of more than 1/8 inch shall be filled or the slope shall be corrected to provide proper drainage. The edges of the fill shall be feathered and smoothed so that the joint between the fill and the original surface is invisible. All corrected work of the asphalt concrete paving shall be of the same mix design.
- 3.6 SEAL COAT:
 - 3.6.1 After completing the flood test and after receiving approvals from the Owner, all new A.C. pavements (minimum 30 calendar days after Owner approvals) shall receive "Laycold Walk Top" as manufactured by Chevron Asphalt Company. The sealer shall consist of suitable fibrated chemical type asphaltic base binders and fillers having a container consistency suitable for troweling after thorough stirring. It shall contain no clay or other deleterious substances.

- 3.6.2 Place the entire contents of each drum sealer in a plaster or pug mill type mixer thoroughly. Where less than 50 gallons of sealer are used, mixing may be done in a mortar box. During mixing, the sealer may be diluted with water to produce a uniform, free flowing consistency, but in no case shall it be diluted with more than one (1) part of water to four (4) parts of "walk top".
- 3.6.3 Areas to receive Walk-Top shall be swept clean and before application, lightly sprayed with water, leaving it cool and damp, but without free water.
- 3.6.4 Apply Walk Top by pouring from a can or a wheeled container in continuous parallel lines and spreading immediately with rubber-faced squeegees or with long-handled hair brooms. The squeegee or broom shall be pulled at an angle from the line of spread to continually roll the material toward the operator and not to overflow or spill over its forward edge away from the operator.

Each coat of sealer shall be thoroughly dry before the succeeding coat is applied.

- 3.6.5 Make two (2) or more applications using at least 35 gallons of sealer (before dilution) per 1,000 square feet of area.
 - 3.6.6 The finished surface seal, when dry and thoroughly set, shall be smooth, tough, waterproof, resilient, of uniform black color and free from coarse textured areas, lap marks, ridges and other surface irregularities. **Should any defects appear in the finished surface, apply as many additional coats of sealer as may be required to produce the specified finished surface at no additional cost.** Protect from traffic during all operations and until the sealer is thoroughly set and cured and does not pick-up under foot or wheeled traffic.
- 3.7 ADJUSTING AND CLEANING:
 - 3.7.1 Cleaning: After completion of paving operations, clean surfaces of excess or spilled asphalt materials or marking paint to the satisfaction of the Architect.
 - 3.8 PROTECTION:
 - 3.8.1 After final rolling, do not permit vehicular traffic on asphalt concrete pavement until it has cooled and hardened, and in no case sooner than 6 hours.
 - 3.8.2 Provide barricades and warning devices as required to protect pavement and the general public.

END OF SECTION

SECTION 32 16 00

CONC PAVING AND WALKS

PART 1 - GENERAL

All applicable portions of Division 1, including the drawings and general provisions of the contract, the general and supplementary conditions and Division 1 specification sections which apply to work of this section as if printed herein.

- 1.1 SECTION INCLUDES: Description of requirements for materials, fabrications and installation of Curbs, Gutters and Walks and accessory items as shown on drawings and necessary to complete the Concrete Work. Work to include but not be limited to the following:
 - 1.1.1 Examine all other sections for work related to those sections which are required to be included as work of this Section.
 - 1.1.2 Concrete curbs, gutters, walks and concrete pavements.
- 1.2 RELATED WORK IN OTHER SECTIONS:
 - 1.2.1 Section 321216 – Asphalt Concrete Paving.
 - 1.2.2 Section 033000 – Concrete Work, except as specified herein.
 - 1.2.3 Section 312200 – Earthwork.
- 1.3 SUBMITTALS: Refer to Section 013300 for procedures.
 - 1.3.1 Provide manufacturer's product data for all materials used and printed recommendations for installation.
 - 1.3.2 Submit all shop drawings as requested by Architect for review and approval, to verify conformance with applicable codes and agencies having jurisdiction.
- 1.4 QUALITY ASSURANCE:
 - 1.4.1 Regulatory Requirements: Comply with applicable portions of codes and regulations of governmental agencies having jurisdiction.
 - 1.4.2 Qualifications: Use skilled workers who are thoroughly trained and experienced and who are completely familiar with the specified requirements and methods to perform and complete the scope of work under Contract.
 - 1.4.3 Protection: Provide all necessary barricades or temporary fencing necessary to protect public and finished work from injury or damage until work is complete.

PART 2 – PRODUCTS AND EXECUTION:

- 2.1 MATERIAL AND WORKMANSHIP: Conform to the applicable sections of "Standard Specifications for Public Works Construction", latest Edition, and all errata and addenda thereto except where noted otherwise in this Section.
- 2.2 WORK PROCEDURES:

- 2.2.1 Pay for all city permits in connection with this work.
- 2.2.2 The local building department will inspect and approve all concrete work within the street right of ways.
- 2.3 COLOR AS APPROVED BY: Architect.
- 2.4 FINISH:
 - 2.4.1 See Paragraph 3.11.2 for ramps and walk finish.
 - 2.4.2 Gutters: Light broom finish with 3-inch wide steel trowel finish at flow lines.
 - 2.4.3 Curbs: Steel trowel finish.
 - 2.4.4 Stair treads and landings: Medium broom finish.
 - 2.4.5 On-Site Drive Aprons: Heavy broom finish.
 - 2.4.6 Curbs adjacent to accessible parking stalls shall be painted blue.
 - 2.4.7 A 2-inch wide line shall be painted with 70 percent contrast epoxy paint, as selected by Architect, with grits adjacent to the nose of all stair treads and shall extend the entire width of each tread.
- 2.5 CRACKING:
 - 2.5.1 Any portion of concrete pavement which develops cracks shall be removed to the nearest joint and replaced. Replaced portions shall match adjacent concrete in texture color and elevation.
- 2.6 EXPANSION JOINT FILLER:
 - 2.6.1 Premolded Joint Filler: Premolded joint filler shall consist of premolded strips of a durable resilient material, and shall be one of the following:
 - 2.6.1.1 Preformed Expansion Joint Filler (Bituminous) ASTM D 994
 - 2.6.1.2 Nonextruding and Resilient Filler (Bituminous) ASTM D 1751
 - 2.6.1.3 Nonextruding and Resilient Filler (Non-bituminous) ASTM D 1752

PART 3 – EXECUTION:

- 3.1 PREPARATION:
 - 3.1.1 Base Course: Sub-grade shall be prepared in accordance with Section 312200 Earthwork.
- 3.2 INSTALLATION:
 - 3.2.1 Formwork:

- 3.2.1.1 Stake rigidly at 4 feet on centers and secure against displacement. Formwork shall not deviate more than 1/2-inch from required vertical positions and 1 inch from required horizontal positions.
- 3.2.1.2 Carefully set forms to alignment, grade, and required dimensions. Hold forms rigidly in place by stakes, clamps, spreaders, and braces where required to insure rigidity.
- 3.2.1.3 Apply form release to form lumber in accordance with manufacturer's recommendations.
- 3.2.1.4 Place joint filler on vertical surfaces in contact with concrete paving.
- 3.2.2 REINFORCEMENT: Upon completion of base course and formwork, install reinforcement where shown on the Contract Drawings.
 - 3.2.2.1 Clean reinforcement to remove loose rust and mill scale, earth, and other materials which reduce or destroy bond with concrete.
 - 3.2.2.2 Position, support, and secure reinforcement against displacement by concrete placement operations.
 - 3.2.2.3 Place reinforcement to obtain the required coverage for concrete protection.
 - 3.2.2.4 All slabs and concrete walkways shall conform to the guidelines and recommendations of the American Concrete Institute for reinforcement of cast-in-place concrete slabs. Care shall be taken to place the reinforcement mid-height in the slab.
- 3.3 QUALITY ASSURANCE:
 - 3.3.1 All work shall be installed by a Licensed Contractor who shall provide a foreman or supervisor who has experience with and knowledge of concrete processes.

The Contractor shall provide a jobsite surface finish sample (100 square feet or 9.3 square meters minimum) to be approved by the Architect prior to the start of the construction. Said sample shall be the standard for the balance of the work installed, and shall be protected against damage until final approval from the Architect. The cost for the construction and protection of the referee sample shall be borne by the Contractor and shall be part of the Contractor's bid.
- 3.4 CONCRETE MIX DESIGN:
 - 3.4.1 For new construction, concrete shall have a minimum compressive strength as follows:
 - 3.4.1.1 Concrete curbs, gutters, sidewalks, and driveway aprons: 2500 psi, concrete type 520-C-2500 in accordance with latest "Greenbook" specifications
 - 3.4.1.2 Concrete cross gutters, ribbon or valley gutters, trash enclosure slabs, and any pavement not otherwise specified: 3250 psi, concrete type 560-C-3250 in accordance with latest "Greenbook" specifications
 - 3.4.1.3 Storm drain catch basins and manholes: 3250 psi, concrete type 560-C-3250 in accordance with latest "Greenbook" specifications

- 3.4.2 Portland cement shall conform to ASTM C150 Type II. Aggregates shall conform to ASTM C33. Mixing water shall be fresh, clean and potable. No admixtures containing calcium chloride shall be permitted.

3.5 OFF-SITE CONCRETE WORK

- 3.5.1 Concrete driveway aprons, street sidewalks, curbs, gutters, etc., indicated to be constructed outside of property lines shall conform to the standards and specifications of the public agency having jurisdiction and shall be subject to inspection by their representative. Obtain and pay for necessary permits. The Owner will pay for inspection fees.

3.6 CURING FOR NEW CONSTRUCTION:

- 3.6.1 All slabs shall be cured properly using conventional five (5) day water cures or using membrane-forming curing agents.

3.7 INSTALLATION PROCEDURES:

- 3.7.1 For new construction, concrete shall be installed in accordance with the standards and specifications of the American Concrete Institute (ACI).
 - 3.7.1.1 Concrete shall be tested in accordance with ASTM F1869-98 and/or ASTM E1970-97.
 - 3.7.1.2 Concrete shall have a pH level between 7-9.
 - 3.7.1.3 Construction joints shall be transferred through the finished surface by tooling them into the finished surface. Construction joints may be filled using a semi-rigid elastomeric material in accordance with manufacturer's recommendations.

3.8 PROTECTION AND MAINTENANCE:

- 3.8.1 Newly completed surfaces shall be protected.

3.9 APPLICATION:

3.9.1 Concrete:

- 3.9.1.1 Mixing: Transit mix the concrete in accordance with provisions of ASTM C94.
- 3.9.1.2 Conveying and Placing: Place concrete in accordance with pertinent recommendations contained in ACI 304 and with the following:
 - 3.9.1.2.1 Deposit concrete continuously in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause formation of seams or places of weakness within the section.
 - 3.9.1.2.2 Deposit and consolidate concrete in a continuous operation within the limits of construction joints until the placing of a panel or section is completed.
 - 3.9.1.2.2.1 Bring surfaces to the correct level with a straight-edge, and then strike off.

3.9.1.2.2 Use bullfloats or derbies to smooth the surface, leaving it free from bumps and hollows.

3.9.1.2.3 Do not sprinkle water on the plastic surface. Do not disturb the surfaces prior to start of finishing operations.

3.9.1.2.4 Do not use concrete which has become non-plastic and unworkable, which does not meet required quality control limits, or which has been contaminated by foreign materials.

3.10 CONTROL JOINTS / WEAKENED PLANE JOINTS:

3.10.1 Tops of joints shall be installed flush with the concrete surface. Depth of joint shall be a minimum of 1/4 the thickness of slab. Use control joints/weakened plane joints on curbs, curbs and gutters, ribbon or valley gutters, and cross gutters at maximum intervals of 10 feet on center. Sawed joints may be used in lieu of the above upon Architect's written approval providing they are at least 1-1/2 inch deep.

3.11 FINISHES:

3.11.1 Paved areas between buildings will consist of various different finishes such as medium and heavy broom, steel trowel exposed aggregate and rock salt. See architectural drawings for specific type of finish for these areas including colored concrete.

3.11.2 Walks, Pavements, Ramps: Unless otherwise noted, medium broom finish perpendicular to longitudinal direction of walks, and at exterior ramps heavy broom finish.

3.11.2.1 Slopes Less Than 6 percent: Surfaces with a slope of less than 6 percent gradient shall be at least as slip-resistant as that described for medium broom finish, perpendicular to the direction of travel.

3.11.2.2 Slopes 6 percent or Greater: Surfaces with a slope of 6 percent gradient or greater shall be slip-resistant, equivalent to a heavy broom finish.

3.11.3 Gutters: Light broom finish with 3 inch wide steel trowel finish at flowlines.

3.11.4 Concrete mow strips or headers: Medium broom finish.

3.12 CURING: *3.11.5 Portland cement concrete paving shall be stable, firm, and slip resistant and shall comply w/ CBC Sections 11B-302 and 11B-403.*

3.12.1 Comply with California Building Code, Title 24, Section 1905A.11, Part 2.

3.12.1.1 Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least seven (7) days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

3.12.2 Curing Methods: Perform curing of concrete by curing as herein specified.

3.12.2.1 Provide moisture-curing by the following methods:

3.12.2.1.1 Keep concrete surface continuously wet by covering with water.

3.12.2.1.2 Continuous water-fog spray.

- 3.12.2.1.3 Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4 inch lap over adjacent absorptive covers.
- 3.12.2.2 Provide curing and sealing compound to exposed exterior slabs, walks, and curbs, as follows:
 - 3.12.2.2.1 Applied specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Re-coat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - 3.12.2.2.2 Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid, floor hardener, waterproofing, damp-proofing, membrane roofing, flooring (such as ceramic or quarry tile, glue-down carpet), painting, and other coatings and finish materials, unless otherwise acceptable to Architect.
 - 3.12.2.2.3 Concrete slabs and paving shall be properly cured and protected against damage and defacement of nature during construction operations. If weather is hot or surface has dried out, spray surface with fine mist of water starting not later than 2 hours after final troweling. Surface of finish shall be kept continuously wet for at least 10 days. Wetting is considered emergency work and shall be performed on weekends and holidays, if necessary.
- 3.12.3 In lieu of water curing, within 24 hours after finishing, the concrete may be cured with a clear liquid curing compound such as "Sealtight No. 1100 Clear" by W.R. Meadows or equal applied in accordance with manufacturer's recommendations.
- 3.13 FIELD QUALITY CONTROL:
 - 3.13.1 Flood Tests: Concrete gutters and concrete pavement shall be given a flood test in the presence of the Inspector. Concrete work where water ponds and does not run off in a reasonable amount of time, shall be removed to the nearest score or joint line and replaced to provide proper drainage. Use a water hose to flood test concrete areas. If water stands 1/8 inches in height or more, then remove the section of concrete from concrete joint to concrete joint.

END OF SECTION

SECTION 32 17 13

PARKING BUMPERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes wheel stops.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified.

PART 2 - PRODUCTS

2.1 PARKING BUMPERS

- A. Concrete Wheel Stops: Precast, steel-reinforced, air-entrained concrete, 4000-psi minimum compressive strength, 4-1/2 inches high by 9 inches wide by 72 inches long. Provide chamfered corners, transverse drainage slots on underside, and a minimum of two factory-formed or -drilled vertical holes through wheel stop for anchoring to substrate.
 - 1. Mounting Hardware: Galvanized-steel spike or dowel, 1/2- diameter, 10-inch minimum length, or lag screw, shield, and washers; 1/2-inch diameter, 8-inch minimum length with hardware as standard with wheel-stop manufacturer.

2.2 INSTALLATION

- A. General: Install wheel stops according to manufacturer's written instructions unless otherwise indicated.
- B. Install wheel stops in bed of adhesive before anchoring.
- C. Securely anchor wheel stops to pavement with hardware in each preformed vertical hole in wheel stop as recommended in writing by manufacturer.

END OF SECTION 321713

SECTION 32 17 23

PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes painted markings applied to asphalt and concrete pavement.

1.2 PREINSTALLATION MEETINGS

- A. Pre-installation Conference: Conduct conference at project site with Construction Superintendent and Architect.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified.

PART 2 - PRODUCTS

2.1 PAVEMENT MARKING PAINT, GENERAL

- A. Accessible parking spaces serving a particular building or facility shall be located on the shortest accessible route to an entrance or to multiple accessible entrances. CBC Sections 11B-208.3.1.
- B. Accessible parking spaces serving more than one accessible entrance shall be dispersed and located on the shortest accessible route to the accessible entrances.
- C. Accessible parking spaces in a parking facility not serving a particular building or facility shall be located on the shortest accessible route to an accessible pedestrian entrance of the parking facility. CBC Sections 11B-208.3.1.
- D. Minimum number of required accessible parking spaces shall be provided in accordance with CBC Table 11B-208.2 for each parking facility provided on a site.
- E. For every six or fraction of six accessible parking spaces, at least one shall be an accessible van parking space. CBC Section 11B-208.2.4.
- F. Accessible parking spaces and access aisles shall comply with CBC Section 11B-502 and shall be dimensioned to the centerline of the marked lines as follows:
 - 1. Parking spaces and access aisles shall be marked according to CBC Figures 11B-502.2, 11B-502.3 and 11B-502.3.3. Their surfaces shall comply with CBC Section 11B-302 and

2.2 MANUFACTURERS & PAVEMENT MARKING PAINT

1. White - Dunn Edwards #IP-901-1, or equal. (parking spaces)
2. Yellow - Dunn Edwards #IP-901-2, or equal. (loading zones, crosswalks, etc.)
3. Blue - Dunn Edwards Vin L Stripe W-801 blue, Sinclair safety blue or equal color to match Color No. 15090 per Federal Standard 595B (ADA path of travel, ADA parking).
4. Parking spaces for the disabled shall be marked according to CBC Section 11B-502.

- B. Glass Beads: AASHTO M 247, Type 1

PART 3 - EXECUTION

3.1 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow paving to age for a minimum of 14 days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
 1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils. Apply paint so that it cannot run beneath the stencil.
 2. Broadcast glass beads uniformly into wet markings at a rate of 6 lb/gal.

END OF SECTION 321723

SECTION 32 17 26

TACTILE WARNING SURFACING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Surface-applied detectable warning tiles.
2. Detectable warning unit pavers.

B. Related Requirements:

1. Section 32 16 00 "Concrete Paving and Walks" for concrete walkways serving as substrates for tactile warning surfacing.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of exposed finish requiring color selection.

C. Samples for Verification: For each type of tactile warning surface, in manufacturer's standard sizes unless otherwise indicated, showing edge condition, truncated-dome pattern, texture, color, and cross section; with fasteners and anchors.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For tactile warning surfacing, to include in maintenance manuals.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

B. Weather Limitations for Mortar and Grout:

1. Cold-Weather Requirements: Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
2. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602. Provide artificial shade and windbreaks, and

use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F and higher.

- a. When ambient temperature exceeds 100 deg F, or when wind velocity exceeds 8 mph and ambient temperature exceeds 90 deg F, set unit pavers within 1 minute of spreading setting-bed mortar.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of tactile warning surfaces that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering and wear.
 - b. Separation or delamination of materials and components.
- A. Warranty Period: Provide minimum 5-year warranty per DSA Bulletin 10/31/02, revised 04/09/08.

PART 2 - PRODUCTS

2.1 TACTILE WARNING SURFACING, GENERAL

- A. Accessibility Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and CCR Title 24 for tactile warning surfaces.
 1. For tactile warning surfaces composed of multiple units, provide units that when installed provide consistent side-to-side and end-to-end dome spacing that complies with requirements.
- B. Source Limitations: Obtain each type of tactile warning surfacing from single source with resources to provide materials and products of consistent quality in appearance and physical properties.
- C. Tactile warning surfaces shall comply with CBC Section 11B-705.1.
- D. Tactile warning surfaces shall be yellow conforming to FS 33538 of Federal Standard 595B, except for locations at curb ramps, islands, or cut-through medians where color used shall contrast visually with that of adjacent walking surfaces, either light-on-dark, or dark-on-light. CBC Sections 11B-705.1.1.3 and 11B-705.1.1.5.
- E. Tactile warning surfaces shall differ from adjoining surfaces in resiliency or sound-on-can contact. CBC Section 11B-705.1.1.4.

2.2 DETECTABLE WARNING TILES

- A. Surface-Applied Detectable Warning Tiles: Accessible truncated-dome detectable warning concrete tiles configured for surface application on existing concrete walkway surfaces, with slip-resistant surface treatment on domes, field of tile, and beveled outside edges.

1. Material: Cast-fiber-reinforced polymer concrete tile.
2. Color: Safety yellow.
3. Shapes and Sizes: As indicated.
4. Dome Spacing and Configuration: As indicated, in manufacturer's standard pattern.
5. Mounting: Adhered and fastened to existing depressed concrete slab walkway.

2.3 DETECTABLE WARNING UNIT PAVERS

- A. Detectable Warning Concrete Unit Pavers: Solid paving units, made from normal-weight concrete with a compressive strength of not less than 5000 psi, water absorption of not more than 5 percent according to ASTM C 140, and no breakage and not more than 1 percent mass loss when tested for freeze-thaw resistance according to ASTM C 67, with accessible detectable warning truncated domes on exposed surface of units.

1. Shapes and Sizes:
 - a. Thickness: 2 inches at field of tile.
 - b. Face Size: Nominal 12 by 12 inches.
2. Dome Spacing and Configuration: As indicated, in square pattern.
3. Color: As selected by Architect from manufacturer's full range.

- B. Mortar Setting Bed:

1. Portland Cement: ASTM C 150/C 150M, Type I or Type II.
2. Sand: ASTM C 33/C 33M.
3. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed, and not containing a retarder.
4. Thinset Mortar: Latex-modified portland cement mortar complying with ANSI A118.4.
5. Water: Potable.

2.4 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of tactile warning surfaces, noncorrosive and compatible with each material joined, and complying with the following:
1. Furnish Type 316 stainless-steel fasteners for exterior use.
 2. Fastener Heads: For nonstructural connections, use flathead or oval countersunk screws and bolts with tamper-resistant heads, colored to match tile.
- B. Adhesive: As recommended by manufacturer for adhering tactile warning surfacing unit to pavement.
- C. Sealant: As recommended by manufacturer for sealing perimeter of tactile warning surfacing unit.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions. Verify that installation of tactile warning surfacing will comply with accessibility requirements upon completion.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF TACTILE WARNING SURFACING

- A. General: Prepare substrate and install tactile warning surfacing according to manufacturer's written instructions unless otherwise indicated.
- B. Place tactile warning surfacing units in dimensions and orientation indicated. Comply with location requirements of AASHTO MP 12.

3.3 INSTALLATION OF DETECTABLE WARNING UNIT PAVERS

- A. Unit Paver Installation, General:
 - 1. Mix unit pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.
 - 2. Cut unit pavers with motor-driven masonry saw equipment to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible.
 - 3. Tolerances: Do not exceed 1/4 inch in 10 feet from level, or indicated slope, for finished surface of paving.
- B. Mortar Setting-Bed Applications:
 - 1. Saturate concrete subbase with clean water several hours before placing setting bed. Remove surface water about one hour before placing setting bed.
 - 2. Apply mortar-bed bond coat over surface of concrete subbase about 15 minutes before placing mortar bed. Limit area of bond coat to avoid its drying out before placing setting bed. Do not exceed 1/16-inch thickness for bond coat.
 - 3. Apply mortar bed over bond coat; spread and screed mortar bed to uniform thickness at subgrade elevations required for accurate setting of pavers to finished grades indicated.
 - 4. Mix and place only that amount of mortar bed that can be covered with pavers before initial set. Before placing pavers, cut back, bevel edge, and remove and discard setting-bed material that has reached initial set.
 - 5. Place pavers before initial set of cement occurs. Immediately before placing pavers on mortar bed, apply uniform 1/16-inch thick bond coat to mortar bed or to back of each paver with a flat trowel.
 - 6. Tamp or beat pavers with a wooden block or rubber mallet to obtain full contact with setting bed and to bring finished surfaces within indicated tolerances. Set each paver in a single operation before initial set of mortar; do not return to areas already set or disturb pavers for purposes of realigning finished surfaces or adjusting joints.
 - 7. Spaced Joint Widths: Provide 3/8-inch nominal joint width with variations not exceeding plus or minus 1/16 inch.
 - 8. Grouted Joints: Grout paver joints complying with ANSI A108.10. Grout joints as soon as possible after initial set of setting bed.

- a. Force grout into joints, taking care not to smear grout on adjoining surfaces.
 - b. Tool exposed joints slightly concave when thumbprint hard.
 - c. Cure grout by maintaining in a damp condition for seven days unless otherwise recommended by grout or liquid-latex manufacturer.
- 9. Remove excess grout from exposed paver surfaces; wash and scrub clean.
 - 10. Protect installation from traffic until grout has set.

3.4 CLEANING AND PROTECTION

- A. Remove and replace tactile warning surfacing that is broken or damaged or does not comply with requirements in this Section. Remove in complete sections from joint to joint unless otherwise approved by Architect. Replace using tactile warning surfacing installation methods acceptable to Architect.
- B. Protect tactile warning surfacing from damage and maintain free of stains, discoloration, dirt, and other foreign material.

END OF SECTION 321726

SECTION 32 31 13

CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes chain-link fences and swing gates.
- B. Related Requirements:
 - 1. Section 03 30 00 "Cast-in-Place Concrete" for cast-in-place concrete post footings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Delegated-Design Submittal: For chain-link fences and gate framework indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of chain-link fence and gate, from manufacturer.
- B. Product Test Reports: For framing strength according to ASTM F 1043.
- C. Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 FIELD CONDITIONS

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

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design chain-link fences and gates, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Chain-link fence and gate framework shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7:
 - 1. Minimum Post Size: Determine according to ASTM F 1043 for framework up to 12 feet high, and post spacing not to exceed 10 feet.

2.2 CHAIN-LINK FENCE FABRIC

- A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:
 - 1. Fabric Height: As indicated on Drawings.
 - 2. Steel Wire Fabric: Wire with a diameter of 0.192 inch.
 - a. Mesh Size: 2 inches.
 - 3. Selvage: Knuckled at both selvages.

2.3 FENCE FRAMEWORK

- A. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 or ASTM F 1083 based on the following:
 - 1. Fence Height: As indicated on Drawings.
 - 2. Horizontal Framework Members: Top and bottom rails complying with ASTM F 1043.
 - 3. Brace Rails: Comply with ASTM F 1043.
 - 4. Metallic Coating for Steel Framing:
 - a. Type A zinc coating.

2.4 TENSION WIRE

- A. Metallic-Coated Steel Wire: 0.177-inch- diameter, marcelled tension wire according to ASTM A 817 or ASTM A 824, with the following metallic coating:
 - 1. Type I: Aluminum coated (aluminized).
 - 2. Type II: Zinc coated (galvanized) by hot-dip process, with the following minimum coating weight:
 - a. Class 4: Not less than 1.2 oz./sq. ft. of uncoated wire surface.

2.5 SWING GATES

- A. General: Gates that are part of the accessible route shall meet all the requirements of an accessible door in compliance with CBC Section 11B-404. Comply with ASTM F 900 for gate posts and single swing gate types.
 - 1. Gate Leaf Width: As indicated.
 - 2. Gate Fabric Height: As indicated.
 - 3. Swing doors and gate surfaces within 10 inches of the finish floor or ground shall have a smooth surface on the push side extending the full width of the door or gate. Parts creating horizontal or vertical joints in these surfaces shall be within 1/16-inch of the same plane as the other and be free of sharp or abrasive edges. Cavities created by added kick plates shall be capped. CBC Section 11B-404.2.10.
- B. Pipe and Tubing:
 - 1. Zinc-Coated Steel: Comply with ASTM F 1043 and ASTM F 1083.
 - 2. Gate Posts: Round tubular steel.
 - 3. Gate Frames and Bracing: Round tubular steel.
- C. Frame Corner Construction: Welded or assembled with corner fittings.
- D. Hardware:
 - 1. Hinges: 360-degree inward and outward swing.
 - 2. Latches permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.
 - a. The levers of lever actuated latches or locks for an accessible gate shall be curved with a return to within ½ inch of the gate surfaces to prevent catching on the clothing or persons. California Referenced Standards code T-24 Part 12, Section 12-10-202, Item (F).

2.6 FITTINGS

- A. Provide fittings according to ASTM F 626.
- B. Finish:
 - 1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. zinc.

2.7 GROUT AND ANCHORING CEMENT

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

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for pavement work, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.
- D. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.
- E. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
- F. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
 - 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 - 2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
 - a. Concealed Concrete: Top 2 inches below grade to allow covering with surface material.
- G. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment as indicated on Drawings.
- H. Line Posts: Space line posts uniformly as indicated on Drawings.
- I. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Provide horizontal tension wire at the following locations:
 - 1. As indicated.
- J. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 1 inch between finish grade or surface and bottom selvage unless otherwise indicated.

- K. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.2 ADJUSTING

- A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Lubricate hardware and other moving parts.

END OF SECTION 323113

SECTION 32 84 00

PLANTING IRRIGATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section covers the furnishings of all materials and performing all operations to provide a complete operable Landscape Irrigation System as directed on the drawings including the following:
 - 1. Trenching, stockpiling excavated material and refilling trenches.
 - 2. Irrigation System components including but not limited to: piping, backflow prevention devices and enclosures, valves, fittings, spray heads, controllers, wiring and final adjustments as determined by the Owner or Owner's Representative to insure efficient and uniform distribution.
 - 3. Pipe connections to backflow prevention devices.
 - 4. Testing and inspection of Irrigation System.
 - 5. Clean up and maintenance.
- B. Related Sections include the following:
 - 1. Division 33 Section "Water Distribution" for water supply piping, water meters, and backflow preventers.
 - 2. Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.
 - 3. Division 31 Section "Site Clearing."
 - 4. Division 32 Section "Tree Protection."
 - 5. Division 32 Section "Landscape Planting" for landscaping.
 - 6. Division 32 Section "Asphalt Paving" for cutting and patching asphalt paving.
 - 7. Division 32 Section "Curbs Gutters Sidewalks & Driveways" for cutting and patching concrete paving.

1.03 DEFINITIONS

- A. Lateral Piping: Downstream from control valves to sprinklers, specialties, and drain valves. Piping is under pressure during flow.
- B. Pressure Piping: Downstream from point of connection to water distribution piping to and including control valves. Piping is under water distribution system pressure.
- C. The following are industry abbreviations for plastic materials.
 - 1. ABS: Acrylonitrile-butadiene-styrene plastic
 - 2. NP: Nylon plastic
 - 3. PE: Polyethylene plastic
 - 4. PP: Polypropylene plastic
 - 5. PTEF: Polytetrafluoroethylene plastic
 - 6. PVC: Polyvinyl chloride plastic

1.04 GENERAL REQUIREMENTS

- A. Code Requirements shall be those of State and Municipal Codes and Regulations locally governing this work, providing that any requirements of the Drawings and Specifications, not conflicting therewith but exceeding the Code Requirements shall govern, unless written permission to the contrary is granted by the Architect.
- B. Conform to the requirements of the reference information listed below except where more stringent requirements are shown or specified in the most current set of construction documents:
 - 1. American Society for Testing Material (ASTM), for test methods specifically referenced in this section.
 - 2. Underwriter's Laboratories (UL), for UL wires and cables.
 - 3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
 - 4. Comply with requirements the City of San Diego Water Utilities Department for preventing backflow and back siphonage.
 - 5. Comply with ASTM F645, "Guide for Selection, Design, and Installation of Thermoplastic Water- Pressure Piping Systems."
 - 6. Comply with NFPA 70, "National Electrical Code," for electrical connections between wiring and electrically operated devices.
 - 7. Furnish plastic pipe and fittings permanently marked with size, class, and type of pipe, working pressure at 73.4 degrees F, and National Sanitation Foundation (NSF) rating.
- C. A licensed and bonded plumbing contractor shall execute work involving substantial plumbing for installation of copper piping, backflow prevention devices and other related work. Obtain any necessary permits prior to beginning work.
- D. Specified depths of pressure supply lines, laterals and pitch of pipes as stated in this section are minimums. Settlement of trenches lower than grades specified on the final grading plans is cause for removal of finish grade treatment, refilling trenches, re-compacting and repairing of finish grade treatment.
- E. Follow current printed manufacturer's specifications and drawings for items or information not specified or graphically indicated in the most current set of construction drawings.
- F. Dimensions indicated are approximate. It is not possible to indicate all required offsets, fittings and other related equipment graphically on the construction drawings. Contractor shall be responsible for minor changes caused by actual site conditions. Before proceeding with any work, Contractor shall carefully check and verify all dimensions of related architectural elements, utilities and landscaping; and furnish and install required fittings.
- G. Do not install the irrigation system as shown on the construction drawings when it is obvious that actual field conditions such as physical obstructions, grading discrepancies and field dimensions vary from those recorded on the construction drawings. Immediately bring any such discrepancies to the attention of the Owner or Owner's Representative prior to proceeding with work. If immediate notification is not given and such discrepancies exist, Contractor shall assume full responsibility for necessary revisions, as determined by the Owner or Owner's Representative.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Exercise caution in handling, loading and storing of plastic pipe and fittings to avoid damage.
- B. Transport pipe in a vehicle with a bed long enough to allow the length of pipe to lay flat so as not to be subjected to undue bending or concentrated external load at any point. Support pipe during storage from sagging and bending. Store plastic piping protected from direct sunlight.
- C. Discard pipe that has been dented or damaged unless such dent or damaged section is cut and rejoined with a coupling.
- D. Protect valves, fittings, and specialties from moisture, dirt, and other possible contaminants.

1.06 SEQUENCING AND SCHEDULING

- A. Install landscape headers, sidewalks, and mowing strips before installation of sprinkler system. Sleeves and mainlines under paving shall be in place before paving construction.
- B. Specimen trees (24 inches box and larger) shall be installed before the location of the irrigation system.
- C. Coordinate sprinkler piping with utility work.
- D. Obtain permission, in writing, from the Owner at least 2 working days before shutting off existing in-use water lines. Contractor shall receive instructions from the Owner as to the exact length of time of each shut-off. Notify the Owner's Landscape Inspector of said intent.

1.07 EXISTING FIELD CONDITIONS

- A. Preserve and protect all existing trees, plants, monuments, structures, hardscape and architectural elements from damage due to work in this section as shown on the Drawings. In the event that damage does occur to inanimate object and structures, Contractor shall repair or replace such damage to the satisfaction of the Owner or Owner's Representative. Contractor at Contractor's expense shall replace damaged or injured living plant material.
- B. Trenching or other work required in this section under the limb spread of existing trees shall be done by hand or by other methods so as to prevent damage or harm to limbs, branches and roots.
- C. Trenching in areas where root diameter exceeds 2 inches shall be done by hand. Exposed roots of this size shall be heavily wrapped with moistened burlap to avoid scarring or excessive drying. Where a trenching machine is operated in proximity to roots that are less than 2 inches, the wall of the trench shall be hand trimmed, making clean cuts through roots.
- D. Trenches adjacent to or under existing trees shall be closed within 24 hours. When this is not possible, the side of trench closest to the tree or trees affected shall be covered with moistened burlap.
- E. Protect, maintain and coordinate work with other contracts, specifications, trades, and utilities. Exercise extreme care in excavating and working in areas where utilities exist. Contractor shall be responsible for damages caused by its operations. In the event that damage does occur, Contractor shall pay the costs of such repairs.

- F. Use caution where trenches and piping cross existing roadways, sidewalks, hardscape, paths or curbs. Contractor shall be responsible for damages caused by its operations.

1.08 REQUIRED DOCUMENTS

A. Service Manuals

1. Submit, prior to beginning construction, a list of irrigation equipment to be used, accompanied by manufacturer's catalog data, specifications, or other literature clearly indicating compliance with specification requirements for each item.
2. Furnish (4) four service manuals to the Owner prior to scheduling a walk through for Substantial Completion. Submit manuals in bound form complete with a table of contents, copy of contractor's warranty, and workmanship form on company letterhead. Manuals shall contain complete large-scale drawings of all installed equipment showing component warranties and catalog numbers together with the manufacturer's name and address. Manuals shall include operation instructions. Manuals shall be subject to approval by the Owner or Owner's Representative as to completeness.

B. Record Drawings

1. Prior to beginning work in the field, secure a complete set of irrigation plans, details, and specifications on reproducible drawings at the original scale. Contractor shall be responsible for making a set of black-line prints for every week on the project. At the end of each working day, Contractor shall record all work accomplished for that day on the set of black-line prints in red ink. These record drawings shall be brought up to date at the end of each workweek by a qualified draftsman. The drawings should indicate the following:
 - a. Any zoning changes.
 - b. Dimension from two permanent points of reference (building corners, fixed hardscape corners, road intersections, permanent existing utilities) the location of the following items:
 - 1) Water meters
 - 2) Connection to existing water lines
 - 3) Routing of pressure supply lines at every 100 feet along routing.
 - 4) Backflow prevention devices
 - 5) Isolation ball valves
 - 6) Quick coupling devices
 - 7) Electric control valves
 - 8) Check valves
 - 9) Field satellite controllers
 - 10) Grounding rods
 - 11) Control wire routing (if routed separately from pressure supply line)
 - 12) Other equipment as directed by Owner.
2. Prior to scheduling a walk through for Substantial Completion, provide a record set of field drawings as described above to the Owner for review. After review, the Owner will return the set to the field foreman requesting further information or will notify that the record set of field drawings are complete. After approval from the owner, a walk through for Substantial Completion may be scheduled.

3. Prior to scheduling the final walk through, the final set of irrigation record drawings shall be professionally drafted.
4. Contractor is responsible for delivering the final set of record drawings to the Owner or Owner's Representative prior to initiating the maintenance period.

C. Controller Charts

1. Provide drawing for each controller unit installed on the project. The controller drawings shall be an actual blue print reduction of the area covered by that controller unit and shall be at the maximum allowable scale that will fit inside the controller door without folding the drawing. The chart shall be a plot plan, entire or partial, showing building(s), walks, roads and walls. Drawings shall show valves and sprinkler heads serviced by that particular controller identifying each station by separate color. Number valves shall match the operation schedule and the drawings. All zones controlled by a controller shall be included on a single sheet. Only those areas controlled by that controller shall be shown. District's Landscape Inspector shall review this print prior to submittal. It shall be hermetically sealed by plastic, and then be secured to the inside door of the controller enclosure.
2. Prepare and submit additional copies of color coded controller drawings as follows: two - 11 inches x 17 inches laminated copies, one - 8 inches x 11 inches laminated copy, and one - 11 inches x 17 inches non-laminated copy.
3. Submit controller charts to the Owner or Owner's representative prior to requesting a walk-thru for substantial completion.

1.09 WARRANTY

- A. Contractor shall warrant materials against defects and guarantee workmanship for the period of one year. Contractor shall be responsible for coordinating warranty items with manufacturer/distributor and Owner.
- B. Settlement of trenches, which may occur during the one-year warranty period, shall be repaired by Contractor at no expense to the Owner.

1.10 EXTRA STOCK AND EQUIPMENT CERTIFICATIONS

- A. Prior to a release of responsibility, schedule a walk through with the Owner or Owner's representative and disclose and provide the following:
 1. Five (5) pop-up spray heads with nozzles and screens of each type used, for every 100 pop-up spray heads installed on the project.
 2. One (1) Quick Coupler key with 90 degree swivel and hose bib attachment, for type and size of quick coupling valve used on project.
 3. One (1) set of the required equipment specific specialty tools for removing, disassembling and adjusting each type of sprinkler head, isolation valve, and electric control valve used on the project.
 4. Two (2) keys for opening and locking each automatic controller.
 5. All manufacturers' rebate certificates (bonus dollars).
 6. One (1) nickel-chrome plated 16-gauge steel 36 inches tube sampler soil probe, as manufactured by Oakfield or approved equal.
 7. All manufacturer's warranty information stating length of warranty and how to exercise warranty on all valves, irrigation controllers and sprinkler heads.
 8. Copy of backflow prevention device equipment operation certification as required by City Regulations.
 9. One (1) operation key for cross handle isolation valves.

10. One (1) operation key for 2" square nut isolation gate valves.
11. Two (2) spare keys matching equipment enclosure locks used.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. The design of the irrigation system is based on the manufacturers and products specified herein or indicated on the Drawings. Substitutions will be permitted only with the Architect or District Landscape Inspector's approval. Where such substitution will change the coverage or flow rates of the sprinkler heads, the request for substitution shall include layout plans showing revised sprinkler head locations. Such revised layout plans shall provide coverages and watering rates equivalent to those indicated. The District's Landscape Inspector shall be notified of any design changes or substitutions.

2.02 PIPING – SCHEDULE 1

- A. General Piping:
 1. Pipe sizes shown are nominal inside diameter unless otherwise noted.
 2. Pipe shall be identified with the following indelible markings:
 - a. Manufacturer's name
 - b. Nominal pipe size
 - c. Schedule or class
 - d. Pressure rating
 - e. NSF (National Sanitation Foundation) seal of approval
 - f. Date of extrusion

2.03 Solvent Weld Pressure Supply Line – PROJECT DATA SHEET 1

- A. Solvent Weld Pressure Supply Line: (downstream of Backflow prevention device) shall be PVC schedule 40 conforming to ASTM D1785-12 for pipe sizes 3/4" through 1 1/2", and PVC Class 315 BE (SDR 13.5) conforming to ASTM D2241 for pipe sizes 2" and larger.
 1. Manufactured from virgin polyvinyl chloride (PVC) compound in accordance with ASTM D2241 and ASTM D1784; cell classification 12454-B.
 2. Type 1, Grade 1.
- B. Fittings: Standard weight, Schedule 40, injection molded PVC, complying with ASTM D1784 and D2466, cell classification 12454-B.
 1. Threads- Injection molded type (where required)
 2. Tees and Ells- side gated
 3. Expansive couplings are not allowed by the District.
- C. Threaded Nipples: ASTM D2464, Schedule 80 with molded threads
- D. Joint Cement and Primer: Type as recommended by manufacturer of pipe and fittings

2.04 Non-pressure Lateral Lines – PROJECT DATA SHEET 2

- A. Non-Pressure Lateral Lines: (downstream of electric remote control valve) PVC Schedule 40, conforming to ASTM D1785-12.

- B. Fittings: Standard weight, Schedule 40, injection molded PVC, complying with ASTM D1784 and D2466, cell classification 12454-B.
 - 1. Threads- Injection molded type (where required)
 - 2. Tees and Ells-side gated
 - 3. Threaded Nipples: ASTM D2464, Schedule 80 with molded threads.
 - C. Joint Cement and Primer: Type as recommended by manufacturer of pipe and fittings
- 2.05 Sleeving and Conduit – PRODUCT DATA SHEET 3
- A. All sleeving for pressure supply line and non-pressure supply lines shall be twice the nominal size of the pipe within, minimum.
 - B. Sleeving and Conduit Material:
 - 1. PVC SCH 40 for 1" to 2½" pressure supply line.
 - 2. PVC SCH 40 for 3" and larger pressure supply line.
 - 3. PVC SCH 40 for non-pressure lines.
 - 4. (1) one ¾" PVC SCH 40 conduit for up to 5 wires.
 - 5. (1) one 1" PVC SCH 40 conduit for up to 8 wires.
 - 6. (1) one 1¼" PVC SCH 40 conduit for up to 15 wires.
 - 7. (1) one 1½" PVC SCH 40 conduit for up to 20 wires.
 - 8. (1) one 2" PVC SCH 40 conduit for up to 30 wires.
 - 9. (1) one 2½" PVC SCH 40 conduit for up to 35 wires.
- 2.06 Copper Pipe and Fittings – PRODUCT DATA SHEET 4
- A. Pressure supply line or Non-Pressure lateral line in structure (per mechanical, structural or mechanical engineers plans): Type K Copper hard tempered, in accordance with ASTM B42-10.
 - B. Fittings: Wrought copper, solder joint type.
 - C. Joints: Solder shall be made up of 45% silver, 15% copper, 16% zinc and 24% cadmium and solids at 1125° F and liquids at 1145° F.
- 2.07 Brass Pipe and Fittings – PRODUCT DATA SHEET 5
- A. Pressure Supply line (from point of connection through Backflow Prevention Device) Brass pipe shall be regular weight, 85% red brass, ANSI Schedule 40 screwed pipe.
 - B. Fittings: Medium brass, screwed at 125 pound class.
- 2.08 BACKFLOW PREVENTION DEVICE – SCHEDULE 2 – PROJECT DATA SHEET 1
- A. Backflow Prevention Device: Reduced pressure principal type ASSE 1013 or ANSI/AWWA C511-07, backflow assembly shall consist of an approved brass or bronze body, brass check valves, hydraulically actuated relief valve, inlet and discharge shutoffs and field test cocks, Febco Model 825YA or approved equal. Manufacturer shall be as indicated on drawings, sized to maximum irrigation system design flow.
 - B. Backflow Prevention Device Enclosure: Enclosure shall have full release locking mechanism, 100% stainless steel, and tube and wire construction. Stainless Steel Backflow Enclosure as manufactured by VIT Products, Strong Box model number SBBC-xxSS or approved equal.

2.09 WYE STRAINERS – SCHEDULE 3 – PROJECT DATA SHEET 1

- A. 2 Inches and Smaller Strainers: Brass or bronze body, 300 pound class with internal screen of 20 mesh stainless steel and tapered self aligned seats.
- B. 2 -1/2 inches and Larger Strainers: Cast iron body, 125-pound class with 50-mesh monel metal screen.

2.10 PRESSURE REGULATORS – SCHEDULE 4 – PROJECT DATA SHEET 1

- A. ASSE 1003, single-seated, direct-operated, water-pressure regulators, rated for 150-psi minimum, initial-inlet working pressure, with size, flow rate, and inlet and outlet pressures indicated (75-125psi adjustable). Include integral factory-installed or separate field-installed Y-pattern strainer that is compatible with unit for size and capacity:
 - 1. 2-Inch NPS (DN50) and Smaller: Bronze body with threaded ends.
 - 2. 2-1/2-Inch NPS (DN65) and Larger: Bronze or cast-iron body with flanged ends.
 - 3. Interior Components: Corrosion-resistant materials

2.11 ISOLATION VALVES – SCHEDULE 7

- A. Isolation Gate Valve – PRODUCT DATA SHEET 1: Bronze, screw-in-bonnet, non-rising stem, cross handle, solid wedge, threaded valve as manufactured by Nibco model T-113-K, or approved equal. Ball type isolation valves shall not be considered by the District.
- B. Isolation Gate Valve – PRODUCT DATA SHEET 2: Iron bolted bonnet with 2” square operating nut, non-rising stem, resilient wedge type, soft seat, flanged end epoxy coated, bronze trimmed iron body. (Use on pipe 3” and greater) as manufactured by Nibco model F-619-RW flanged, or approved equal.
- C. All isolation valves shall be set in a valve box in accordance with Section 3.15 and SCHEDULE 11 – VALVE BOXES. Mark all isolation valves with “GV” on lid.

2.12 QUICK COUPLING VALVES – SCHEDULE 8

- A. Quick Coupler Assembly – PRODUCT DATA SHEET 1: Two-piece unit consisting of a coupler water seal valve assembly and a removable quick connecting coupler key designed to allow spring and key track to be serviced without shutdown of main. A positive, watertight connection shall be made between coupler key and valve.
- B. Coupler Valve: Double lugged type, 1 inch size, designed to withstand a working pressure of 150 psi. Bodies of valves shall be red brass. Provide valves with lockable hinged covers with springs for positive closure on key removal. Covers shall be red brass with a permanently bonded rubber-like vinyl cover, yellow in color. Manufactured by Rain Bird Manufacturing Corporation, model 44-LRC.
- C. Quick Coupler Key: Brass or bronze with a hose bib assembly.

2.13 ELECTRIC CONTROL VALVES – SCHEDULE 9

- A. Remote Control Valves – PRODUCT DATA SHEET 1: Valve shall be as manufactured by Rainbird Manufacturing Corporation, EFB-CP Series, brass (without pressure regulator option), no substitutions. Control Valves shall be set in a valve box per Section 3.15 and SCHEDULE 11 – VALVE BOXES in this specification. Mark all control valve boxes with station number.

- B. Valve identification tags – PRODUCT DATA SHEET 2: Shall be pre-printed, double sided standard yellow tags as manufactured by Christy's or approved equal.
- 2.14 CHECK VALVES – SCHEDULE 10
- A. Swing Check Valves – PRODUCT DATA SHEET 1: Brass or bronze 100 pound class for non-pressurized lines.
 - B. Spring Check Valves – PRODUCT DATA SHEET 2: King Brothers KC-XXX-S, PVC, Thread x Thread, stainless steel internal parts and adjustable spring tension from 4 to 15 psi, to prevent low sprinkler head drainage.
- 2.15 VALVE BOXES – SCHEDULE 11 – PRODUCT DATA SHEET 1
- A. Valve Boxes: Boxes adjacent to paved areas subject to vehicular traffic shall be precast concrete with cast iron lids designed to resist vehicular traffic. Concrete valve boxes shall have lockable covers. Boxes in all other areas shall be plastic valve boxes as follows:
 - B. Quick Couplers, Isolation Gate Valves, Manifold Ball Valves, Spare Wire Boxes and Pull Boxes: Round 10" diameter valve box, green in color, with stainless steel hex bolt, including washer, size and type to secure lid. Carson L Series 910 with "T" cover manufactured by Oldcastle Precast, Inc. or approved equal.
 - C. Electric Control Valves: Rectangular 12" valve box, green in color, with stainless steel hex bolt, including washer, size and type to secure lid. As manufactured by Carson-Brooks Series 1419-12-2B hinged cover or approved equal.
- 2.16 SPRAY HEADS – SCHEDULE 12
- A. Pop-up Spray Type – PRODUCT DATA SHEET 1: Full or part circle pop-up spray type sprinkler body, stem, nozzle and screen constructed of heavy-duty plastic. The sprinkler shall have a soft wiper seal for cleaning debris from pop-up stem as it retracts into case to prevent sprinkler from sticking up. The sprinkler shall have a matched precipitation rate plastic nozzle with an adjusting screw capable of regulating the radius and flow. The sprinkler shall have a strong stainless steel retract spring for positive pop down. Pop-up height shall be as indicated on plans. The sprinkler head shall have a screen under the nozzle to protect it from clogging and for easy removal for cleaning and flushing system. The sprinkler head shall have a bottom inlet and may have a side inlet for ease of installation. Use only the bottom inlet for sprinkler heads equipped with anti-drain devices. Manufactured by Rainbird 1800-SAM series (without the PRS option), or approved equal.
- 2.17 PREASSEMBLED AUTOMATIC CONTROLLER UNIT WITH ENCLOSURE – SCHEDULE 13 – PRODUCT DATA SHEET 1 / PRODUCT DATA SHEET 2
- A. The number and location of the controller shall be as shown on the drawings and shall be as manufactured by Weathermatic. It shall be a Smartline SL1600 controller with an SLM4 module. The controller shall be installed in a stainless steel Pedestal Enclosure SLPED-ENC-SS. The District's Irrigation Control System Specialist shall be contacted for confirmation prior to placing equipment order.
 - B. The controller shall be capable of being operated manually at any time. A manual single station, a group of stations, or a program can be selected to run for a programmed time or a new time setting without affecting the normal program.

- C. In local field control and operation, the controller shall be capable of being manually operated on any one of the stations for a single-station operation, any portion of a cycle or a complete cycle manually started, as desired.
- D. The controller shall be covered by a five year limited warranty.

2.18 WEATHER STATION EQUIPMENT – SCHEDULE 14 – PRODUCT DATA SHEET 1

- A. Controller shall be provided with one weather station connected to the controller. Type used shall be SLW1 as manufactured by Weathermatic. Conduit for wall mounting to be per District Specifications (including U-channel wall mounting brackets), and shall meet Division 26 requirements. Wireless communication option is acceptable to the District.

2.19 ELECTRIC CONTROL VALVE WIRE – SCHEDULE 15

- A. PRODUCT DATA SHEET 2: All conductors shall be the same type and shall be of the sizes indicated on the drawings as required for proper operation of the systems.
- B. PRODUCT DATA SHEET 3: All wire for control for valves shall be insulated solid copper conductor of a type approved for direct burial. Provide a different color for each controller, and install per valve manufacturer's specifications and wire chart. Common wire for each controller shall be white with stripe of same color as controller wires. Extra wires shall be black, one extra from controller to each valve manifold.
- C. PRODUCT DATA SHEET 4: Sizing of low voltage wire shall be in accordance to manufacturer's recommendations, in no case less than #14 in size. AWG UF UL approved direct burial copper wire for all control wires and all common wires.
- D. PRODUCT DATA SHEET 5: 120 volt wire to be type required by local codes and ordinances, of proper size to accommodate needs of equipment serviced.
- E. PRODUCT DATA SHEET 7: Connections on 24-volt wire shall be made by Pentite pre-filled waterproof connector, or approved equal.
- F. Trench Marker Tape – PRODUCT DATA SHEET 8: Tape shall be detectable, blue marking tape with the words "Caution – Irrigation Line Buried Below." Widths shall be at least ¾ of the diameter of the pipe being protected. Tape shall be manufactured by "Christy's" or approved equal.

2.20 SAND BEDDING – SCHEDULE 17 – PRODUCT DATA SHEET 1

- A. Sand bedding on all pipe shall be clean construction grade type.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine field conditions prior to beginning the work of this section. Grading operations shall be completed and approved prior to beginning work.
- B. Verify all sleeve locations prior to beginning work in this section. Flag all existing sleeves and conduits installed by other trades. Report any conflicts and discrepancies to the Owner's Representative immediately.
- C. Verify location of existing underground utilities, valves, manholes, catch basins, and other appurtenances that will affect the layout of the sprinkler system. Verify location of

existing trees, new specimen trees, and other obstructions that will affect the layout of the sprinkler system. Verify location of stub outs and points of connection to the water supply system.

3.02 PREPARATION

- A. Locations of piping and equipment indicated on plans are diagrammatic and approximate and shall be adjusted as necessary and as directed to meet existing conditions and obtain complete water coverage. Contractor is responsible for irrigation system operation and complete coverage of the system. Report any conflicts and discrepancies to the Architect and District Landscape Inspector immediately.
- B. Sprinkler lines shall have a minimum clearance of 6 inches from each other and from other utility lines. Do not install parallel lines directly over one another.
- C. Construct irrigation system to the sizes and grades at the locations indicated. Mark with powdered lime or marking paint routing of pressure supply line and stake the location of each spray head, electric control valve and other related equipment. Owner's Representative shall review staking and direct any necessary changes with Contractor prior to proceeding to other zones. This review does not in any way alleviate Contractor from the responsibilities associated with proper uniformity and distribution of head placement after staking.
- D. Install sleeves to accommodate pipes and wires under paving, hardscape areas, sidewalks, and paths prior to asphalt and concrete operations. Compact backfill around sleeves to 95% Modified Proctor Density within 2% of optimum moisture content in accordance with ASTM D1557. Where not yet utilized, close sleeve ends with cloth duct tape.

3.03 EXCAVATION AND BACKFILLING OF TRENCHES

- A. Follow layout indicated on drawings as closely as possible in excavating trenches. Trenches shall be straight in alignment and support pipe continuously on bottom of trench. Remove rocks and debris greater than 1" in diameter. Over excavate as required for bedding material.
- B. Depth of Trench (in landscape areas):
 - 1. Pressure Supply Line: 18" from top of pipe to finish grade.
 - 2. Non-Pressure Line (for all non-rotor sprinkler heads and 6" popup heads): 12" from top of pipe to finish grade.
 - 3. Control Wiring: directly at side and bottom of pressure supply line.
 - 4. Pressure Supply line Locator Tape: above pipe, 6" below finish grade, (at a maximum depth of 12").
- C. Depth of Trench (under asphalt paving or concrete, pipe and wires to be in sleeving):
 - 1. Pressure Supply Line: 36" from top of finish grade to top of sleeve.
 - 2. Non-Pressure Line: 24" from top of finish grade to top of sleeve.
 - 3. Control Wiring: Directly at side and bottom of pressure supply line.
 - 4. Pressure Supply Line Locator Tape: Above pipe, 6" below finish grade, at a maximum depth of 12".
 - 5. Piping located under asphalt paving or concrete shall be installed with the appropriate sized sleeve. Backfilled with sand bedding (6" below pipe and 6" above pipe).
- D. Width of Trench:

1. Pipe greater than 3": 14" minimum.
 2. Pipe less than 3": 7" minimum.
- E. Width Between Trenches:
1. Irrigation trench to irrigation trench: 6" minimum.
 2. Irrigation trench to other trade trenches: 12" minimum.
- F. Sleeves: Provide appropriate sized sleeves for piping located under asphalt paving or concrete.
- G. Boring: Boring is only permitted where pipe must pass under an obstruction that cannot be avoided or removed. Backfill shall match surrounding soil density and grain. Boring under existing paving, sidewalks, or hardscape shall be permitted at Contractor's risk. Contractor shall repair all damage to such items at its own expense.
- H. Backfilling: Backfilling of trenches shall not be done until all required testing for the irrigation system has been completed.
1. Material: Excavated material is generally considered to be adequate for backfilling operations. Before beginning the backfilling operation, insure that backfill material is free from debris and rocks greater than 1" in diameter, and is not mixed with topsoil. These materials after separated from backfill, shall be legally disposed of at Contractor's expense.
 2. Bed pressure supply line with construction grade sand 6" above and 6" below pipe. Remaining backfill shall be as described above.
 3. Bed all electrical control wire and communication cable wire, trenched separate from pressure supply line, with construction grade sand 6" above and 6" below wires.
 4. Bed all sleeves with sand bedding with construction grade sand 6" above and 6" below pipe sleeves.
 5. Set in place, cap and pressure test piping in the presence of the Owner's Representative prior to backfilling.
 6. Compact backfill to a 90% maximum density in accordance with ASTM D1557 with a mechanical tamper. Do not leave trenches open for a period greater than 48 hours. Open trenches shall be protected in accordance with current OSHA regulations. Slightly mound filled trenches for settlement after backfilling is compacted.
 7. Smooth trenches to match surrounding finish grade prior to requesting walk through for Substantial Completion.

3.04 POINT(S) OF CONNECTION

- A. Point of connection shall be approximately as indicated on drawings. Connect new underground piping and valves, and provide all flanges, adapters, or other necessary fittings.

3.05 INSTALLATION OF SOLVENT WELD POLYVINYL CHLORIDE PIPE (PVC)

- A. Polyvinyl chloride pipe shall be cut with an approved PVC pipe cutter designed only for that purpose.
- B. All plastic-to-plastic solvent weld joints shall use solvent recommended by the pipe manufacturer. Do not install solvent weld pipe when temperature is below 40° F.

- C. Pipe ends and fittings shall be wiped with MEK, or approved equal, before welding solvent is applied. Welded joints shall be given a minimum of 15 minutes to set before moving or handling.
- D. Snake pipe from side-to-side on trench bottom to allow for expansion and contraction.
- E. All changes of direction over 15 degrees shall be made with appropriate fittings.
- F. When pipe laying is not completed by the end of the workday, close pipe ends with tight plug or cap.
- G. Install pressure supply line locating tape along the entire length of pressure supply line.
- H. Coordinate pressure supply line with sand bedding operations.
- I. No water shall be permitted in the pipe until inspections have been completed and a period of at least 24 hours has elapsed for solvent weld setting and curing.
- J. Center load pipe with small amount of backfill to prevent arching and slipping under pressure. Leave joints exposed for inspection during testing.

3.06 INSTALLATION OF COPPER PIPE

- A. Copper piping shall be cut by a power hacksaw, a circular cutting machine using an abrasive wheel, or by means of a hand hacksaw. No piping shall be cut with a metallic wheel cutter of any description. All pipes shall be reamed and rough edges or burrs removed so that a smooth and unobstructed flow is obtained.
- B. Eccentric reducing fittings shall be used where change in pipe size occurs. Bushings shall not be used unless specifically authorized by the Owner's Representative.
- C. Apply emery cloth to pipe ends and wipe with clean cloth prior to solder welding pipe end to fitting. Apply an even layer of flux along area to be soldered. Apply solder uniformly around joint and let cool. After cooling lightly apply emery cloth along soldered area until smooth.
- D. All exposed piping under structural slabs shall be stenciled with "Irrigation Main" or "Irrigation Lateral" as required, at ten foot (10') intervals in black permanent ink lettering, 3/4" minimum high.

3.07 INSTALLATION OF BRASS PIPE

- A. Brass piping shall be cut by a power hacksaw, a circular cutting machine using an abrasive wheel, or by means of a hand hacksaw. All pipes shall be reamed and rough edges or burrs removed so that a smooth and unobstructed flow is obtained.
- B. Eccentric reducing fittings shall be used where change in pipe size occurs. Bushings shall not be used unless specifically authorized by the Owner's Representative.
- C. Carefully and smoothly place joint compound on the male thread only. All screwed joints shall be tightened with tongs or wrenches. Caulking of any kind is not permitted.
- D. All exposed piping under structural slabs shall be stenciled with "Irrigation Main" or "Irrigation Lateral" as required, at ten foot (10') intervals in black permanent ink lettering, 3/4" minimum high

3.08 INSTALLATION OF BACKFLOW PREVENTION DEVICE

- A. Install backflow prevention device and associated equipment as close as possible to the water meter or point-of-connection. Installation detail shall be per District Standard Detail drawing.
- B. Coordinate installation with local governing codes and ordinances. No pressure regulator shall be installed unless supplied pressure exceeds 80 psi, per California Plumbing Code. Install Y-strainer after the backflow device per City of San Diego Regulations.
- C. Install backflow device with stainless steel enclosure and keyed lock.

3.09 INSTALLATION OF GATE VALVES

- A. Install gate valves in separate round valve boxes as specified on District Standard Detail drawings. All plastic valve boxes shall be secured with a stainless steel locking bolt mechanism, and set over ¾" gravel with filter fabric.

3.10 INSTALLATION OF QUICK COUPLING VALVES

- A. Install quick coupling valves with brass riser set in concrete footing. Set plumb and true in center of box with QCV top 3" below box lid. Ensure that proper quick coupling key operation is provided with each installation.
- B. Install in separate round valve box secured with a stainless steel locking bolt mechanism. Set over ¾" gravel with filter fabric.

3.11 INSTALLATION OF ELECTRONIC CONTROL VALVES

- A. Install each electric control valve in a separate valve box so that cross handle is 3" minimum below valve box cover. Install with union type connection. All plastic valve boxes shall be secured with a stainless steel locking bolt mechanism, and set over ¾" gravel with filter fabric.
- B. Group electric control valves together with no more than 3 per cluster. Allow a maximum of 12" between each valve boxes. Install valve boxes in the same direction and parallel with one another and perpendicular to paving, hardscape, sidewalks and paths. Install each manifold group with a ball valve sized equal to the largest non pressure lateral line in the manifold.

3.12 INSTALLATION OF CHECK VALVES

- A. Install check valves in a separate round valve boxes at a maximum of 10" below valve box cover. Plastic valve boxes shall be secured with a stainless steel locking bolt mechanism, and set over ¾" gravel with filter fabric.

3.13 INSTALLATION OF VALVE BOXES

- A. Install valve boxes with each type of irrigation equipment so that top of valve box is above finish grade as specified on the District Standard Detail drawings. Valve box extensions are not acceptable except for mainline isolation gate valves.
- B. Place gravel sump below and around each valve box prior to installing valve box as specified on the detail drawings. Place remaining portion of gravel inside valve box, allowing full access in and around all fittings. Valve box shall be fully supported by gravel sump. No brick or wood supports are allowed.
- C. Brand the valve box lid of associated equipment as follows:

1. Electric control valve box lid with "Controller Letter and Station Number."
 2. Quick coupling valve box lid with the letters "QC."
 3. Isolation gate valve box lid with the letters "GV."
 4. Spare Wire box lids with the letters "SW."
 5. Wire Splice box lid with the letters "WS."
 6. Grounding rod valve box lid with the letters "GR."
 7. Check valve box lid with the letters "CV."
- D. Letter and number size of brands shall be no less than 1" and no greater than 1 1/2" in height and shall be 1/8" maximum in depth. Provide sample branding to the Owner or Owner's Representative prior to commencement of work. Coordinate with Owner or Owner's Representative any non-listed equipment box identification required.
- E. Walk through for Substantial Completion shall not be allowed until all branding is complete and approved by Owner or Owner's Representative.

3.14 INSTALLATION OF SPRAY HEADS

- A. Flush circuit piping with full water pressure and install sprinklers after hydrostatic test is completed.
- B. Locate part circle sprinklers to maintain a minimum distance of 2" to a maximum of 4" between paving, hardscape, sidewalks, and paths and a minimum distance of 12" from walls.
- C. Spray heads shall not exceed the maximum head and row spacing specified on the drawings or staked in the field unless approved by the Owner's Representative. In no case may spray heads or rotors be installed at a distance between heads that exceeds the manufacturer's recommended distance.
- D. Angled nipples on swing joints below spray heads or any sprinkler type, where applies, shall not exceed 45° nor be less than 10°.
- E. After installation adjust nozzle sizes, arcs and radius of throw to allow head to head uniform distribution. No overspray will be allowed on paving, hardscape, sidewalks, and paths.
- F. Adjust adjacent new plant material placement or trim existing plants so that it does not interfere with uniform distribution of each spray head.
- G. Architect or District's Landscape Inspector may request nozzle changes and/or adjustments without additional cost to the Owner.

3.15 INSTALLATION OF AUTOMATIC CONTROLLER UNIT

- A. Verify electrical power at location of automatic controller unit prior to its installation. Control unit shall have a dedicated separate circuit on the panel. Electrical panel and circuit number serving the irrigation control equipment to be labeled inside the controller enclosure.
- B. Hardwire controller to the on/off switch and existing power source. Controller shall not be plugged into socket provided for other equipment.
- C. Install automatic controller unit where indicated on drawings on concrete base, plumb and true per manufacturer's specifications. Controller shall be tested with complete electrical connections.

- D. Connect electric control valve assembly wiring to controller unit in the same numerical sequence as indicated on the drawings, or as directed by the Owner's Representative in the field.
- E. Install a separate ground wire for each controller unit as specified on the drawings and per manufacturer's specifications. Each cluster control unit, satellite and decoder shall be grounded by means that conform to the requirements of the National Electrical Code, current edition as adopted by the City of San Diego, the California Electrical Code, and the manufacturer's specifications. An 8-foot height grounding rod shall be used. No solder connections will be allowed. Resistance to ground shall be no greater than 5 ohms.
- F. Above ground conduit shall be rigid galvanized pipe with the appropriate fittings. Below ground conduit shall be PVC SCH 40 pipe with appropriate sweeps and fittings. Conduit sweeps shall extend a minimum of 3" above concrete controller base.
- G. Label each automatic controller unit with the letter or number designated on the drawings. Letter or number shall be located in a visible location on the inside panel cover with 3" high vinyl letters.
- H. Each automatic controller unit shall be completely operable and sequence tested prior to scheduling a walk through for substantial completion.

3.16 INSTALLATION OF ELECTRICAL WIRE

- A. Low Voltage Wiring:
 - 1. Bury control wiring in same trench as pressure supply line as specified.
 - 2. Bundle all 24 volt wires at 20' intervals with electrical tape.
 - 3. Provide expansion loops at every pressure supply line angle fitting, inside each electric remote control valve box, and at 250' length intervals along routing. Form expansion loop by wrapping wire a minimum of 10 times around a 3/4" pipe and withdrawing pipe.
 - 4. Limit splicing of electrical wiring. Provide each splice made at intervals or in electric control valve assembly valve boxes with approved connectors.
 - 5. Wire splices occurring at intervals outside electric control valve box shall be installed in a separate valve box.
 - 6. Provide (1) one electrical control wire for every electric remote control valve. Piggy backing like zones on the same electrical control wire or into the same station terminal is not allowed.
 - 7. Install (2) two spare #14-1 electrical control wires (with common wire) from the automatic controller unit pedestal to the last electric control valve on each leg of pressure supply line. Locate the spare wires in their own valve box as specified. Provide (1) one additional spare electrical control wire at every electric remote control valve manifold (valve grouping). In addition to these spare wires, check the drawings for additional wires that are required and locate them in the same valve box as the spare wires. Length of spare wires at each end enclosure shall be sufficient for connection into possible fixture equipment or connection point.
- B. High Voltage Wiring: Install 120 volt power source to automatic controller unit following local governing codes and ordinances.

3.17 CONTROL EQUIPMENT INSPECTION

- A. Contractor shall cause the following warranty tests to be performed by Weathermatic, equipment supplier, on all electrical circuits and system components, and shall submit a

written approval from the equipment supplier to the District Landscape Inspector prior to the start of the maintenance period. All tests shall be made to the satisfaction of the District Landscape Inspector:

1. Each circuit shall be tested for continuity.
2. Each circuit shall be tested for leaks to ground with an ohmmeter after each interconnect circuit has been installed and connections have been made. No circuit checking lower than 1 megohm will be acceptable.
3. The grounding system shall be tested with a meter and shall not measure more than 5 ohms.
4. A functional test shall be made in which it is demonstrated that each and every part of the system functions as specified or intended. The test may commence only with the approval of the District Inspector.
5. The functional test for each new or modified electrical system shall consist of not less than five days of continuous, satisfactory operation. If unsatisfactory performance of the system develops, the condition shall be corrected and the test shall be repeated until the five days of continuous satisfactory operation are obtained.
6. Shutdown caused by factors beyond the contractors control shall not constitute discontinuity of the functional test.
7. Any material revealed by these tests to be faulty shall be replaced or corrected, and the same test shall be repeated until no fault is evident.
8. Results of circuitry tests shall be recorded and submitted to the District Inspector prior to acceptance of work.

3.18 CONTROL EQUIPMENT SUPPLIER REPORT

A. The equipment supplier shall be responsible for the following system support:

1. Conduct on-site system familiarization meeting for Contractor, Irrigation Consultant, and District's Landscape Inspector to insure that all personnel understand the system installation technique, and when and how to utilize Weathermatic support.
2. Provide on-site technical assistance during installation period when requested by Contractor, Irrigation Consultant, or District representative.
3. Test grounding system to verify that equipment is properly grounded.
4. Perform continuity and resistance test on communication wire to insure that proper voltage will be delivered to the equipment on line.
5. Certify that equipment conforms to and is installed in accordance with plans, specifications and manufacturers recommendations.
6. Test system components for proper operation.

3.19 QUALITY CONTROL

- A. Preconstruction Meeting: Contractor is responsible for contacting the Architect, Owner, and Owner's Representative, prior to beginning construction and/or ordering materials, to establish a meeting to review and discuss project objectives, concerns and to review the construction documents to insure a complete understanding of required installation procedures.
- B. General Observation: The District's Inspector will visit the construction site at interim times during the construction process to access construction progress regarding installation of irrigation equipment to be in compliance with the drawings, details, specifications and site conditions. The District's Inspector will prepare a site report after each visit noting progress of installation, verbal communication with Contractor and identifying any field adjustments necessary which require modifications to the designed

irrigation system. A copy of this site report will be delivered to both Contractor and the District's Construction Manager. Contractor shall immediately address each item on the site report before proceeding with further construction.

- C. Hydrostatic Pressure Testing the Pressure Supply Line: After backfilling, flushing, and prior to the installation of each electric control valve, drip valve assembly, isolation ball valve, quick coupling valve, and manual drain valve the irrigation system shall be pressure tested.
 - 1. Pressure testing shall be performed in the presence of the Architect and Owner or Owner's Representative utilizing the following procedure:
 - a. Pressurize the irrigation system to 40 psi greater than the designated static pressure or 150 psi whichever is greater for a period of no less than 4 hours. The pressure gauge used for the pressure test shall not exceed readings greater than 300psi. Pressure pump and other equipment necessary for the test shall be furnished by Contractor.
 - b. Test is acceptable if no leakage occurs within the system for the duration of the testing period.
 - c. If leaks occur, repair said leaks and begin pressure test again. Repeat this operation until no leaks occur in the irrigation system.
 - d. Before requesting a walk through for Substantial Completion, the entire irrigation system shall remain under pressure for a period of no less than 48 hours.
- D. Inspection: In cases where inspection of the sprinkler system construction is required or where portions of the construction are specified to be performed under the direction or inspection of the District's Inspector, Contractor is required to notify the District's Inspector at least 3 working days in advance of the time such inspection or direction is required. Inspection will be required for the following parts of the construction:
 - 1. Upon installation and testing of main lines and lateral lines; when pipes are laid and are to be submitted to pressure tests. Do not cover lines until they have been inspected and approved.
 - 2. Upon installation and testing of valves, quick couplers, backflow preventer device, automatic controllers, control valves, and wires.
 - 3. When the sprinkler system is completed, perform a coverage test, in the presence of the District's Landscape Inspector, to determine if the coverage is complete and adequate for the lawn and planting areas. Furnish materials and perform construction required to correct inadequacies in the coverage.
 - 4. Final inspection and performance test shall be at the same time as the final inspection of the landscape construction.
- F. Flushing: Center load all piping prior to flushing. After all new irrigation piping and risers are in place and connected and all necessary diversion work has been completed and prior to the installation of sprinkler heads, rotors and quick coupling valves, thoroughly flush piping system under full head of pressure. After the furthestmost riser from the point of connection begins to flush, continue flushing for duration of five minutes. After the system is thoroughly flushed, cap all risers.
- G. Repairs required due to vandalism before final acceptance will be performed at the contractor's expense.
- H. Walk Through for Substantial Completion:

1. Before requesting a walk through for Substantial Completion the following requirements must be entirely satisfied:
 - a. The entire irrigation system shall be completely installed, flushed and satisfactorily pressure tested. If Contractor fails to notify the Architect and District Inspector for the pressure test and flushing procedures stated above then Contractor assumes full responsibility for any design modifications directed by the District during the walk through for Substantial Completion regarding pressure and flushing issues.
 - b. All valve boxes shall be branded.
 - c. All automatic controllers or field satellite units are fully operable, control equipment has been certified by Weathermatic and operation tested for interface with the District's Irrigation Central Control System (through District's Irrigation Control System Specialist in the Energy / Utilities Management Section).
 - d. Record drawings shall have been submitted to the Architect and Owner for review as to completeness.
 - e. (4) Four Services manuals shall have been delivered to the Owner or Owner's Representative.
2. Once the above requirements have been met a walk through for Substantial Completion shall be requested. The following procedures shall be used during the walk through:
 - a. Contractor shall have (2) two personnel available with radio communication for the entire length of the walk through.
 - b. All valve box lids shall be removed from valve boxes and placed faced up adjacent to the valve box prior to beginning the walk through.
3. The scheduling of each walk through type will be divided over several days as needed to provide adequate time to complete the review of all zones. The walk through will be divided into (2) two sections and proceed as follows:
 - a. Visual Walk Through: This will consist of walking through the entire irrigation system and examining all components of the system without turning on zones. A punch list will be established of deficiencies in the construction and workmanship of the irrigation system as compared to the construction drawings, details, and specifications.
 - b. Operational Walk Through: This will consist of walking through the entire irrigation system observing each zone in a fully operable condition. Valves must be activated from the automatic controller unit (Manual bleeding of individual electric control valves and drip valve assemblies will not be acceptable). A punch list will be established of deficiencies in the operation of each zone in the irrigation system evaluating but not limited to head spacing, row spacing, nozzle sizing, correct radius of throw, correct stationing, and flushing operation of zones as compared to the construction drawings, details, and specifications.
 - c. Once the Walk Through for Substantial Completion has been completed the Architect will provide a copy of all punch list items to the Owner for review and distribution to Contractor. It is Contractor's responsibility to repair, replace, and adjust all items on the punch prior to requesting a final walk through.

H. Final Walk Through:

1. Before commencement of a final walk through is requested, the following requirements shall be entirely satisfied:
 - a. Each item on the walk through for Substantial Completion shall be thoroughly addressed and resolved by Contractor.
 - b. All final record drawings shall have been provided to the Architect and submitted to the Owner.
 - c. The maintenance manual for the project shall be completed and submitted to the Owner.
 - d. Controller charts for automatic controller unit shall be completed, installed, and submitted to the Owner.
2. Once the above requirements are met a final walk through shall be requested. The following procedures will be used:
 - a. Contractor shall have (2) two personnel available with radio communication for the entire length of the walk through.
 - b. Only those valve box lids shall be removed from valve boxes as indicated on the walk through for Substantial Completion punch list. The valve box lids shall be placed faced up adjacent to the valve box prior to beginning the final walk through.
3. The final walk through shall be divided into (2) two sections and proceed as follows:
 - a. Visual Walk Through: This will consist of walking through the punch list items created at the time of the walk through for Substantial Completion, examining all components of the system without turning on zones. Any remaining deficiencies in the construction and workmanship of the irrigation system as compared to the punch list generated at the time of the walk through for Substantial Completion, construction drawings, details and specifications will be noted.
 - b. Operational Walk Through: This will consist of walking through the punch list items created at the time of the walk through for Substantial Completion and observing each zone in a fully operable condition. Valves shall be activated from the automatic controller unit (Manual bleeding of individual electric control valves will not be acceptable). Any remaining deficiencies in the operation of each zone in the irrigation system including but not limited to head spacing, row spacing, nozzle sizing, correct radius of throw, correct stationing, and flushing operation of zones as compared to the punch list generated at the time of the walk through for Substantial Completion construction drawings, details, and specifications.
 - c. Once the Final Walk Through is completed and all items noted on the final punch list have been addressed the maintenance period shall begin. Any additional walk throughs required due to Contractors' inability to address all issues on the punch lists described above will be provided at Contractor's expense.

3.20 MAINTENANCE PERIOD

- A. The Maintenance Period shall be as indicated in the Agreement and shall begin once all items on the final walk through punch list have been satisfactorily addressed by a written statement indicating such from the Architect and the Owner.

1. Contractor is responsible for obtaining and following the maintenance manuals created specifically for the project from the Owner at the beginning of the maintenance period.
2. Demonstrate to District's maintenance personnel operation of equipment, sprinklers, specialties, and accessories. Review maintenance information.
 - a. Provide seven days' advance written notice of demonstration.
3. At the end of the maintenance period and prior to turning the project over to the Owner, Contractor shall deliver the following to the Owner:
 - a. All necessary maintenance materials.
 - b. Extra stock as specified elsewhere in this Section.
4. Once Contractor has fulfilled all maintenance agreement obligations and has provided the above items to the Owner, the maintenance period will end.

END OF SECTION

SECTION 32 91 00

PLANTING PREPARATION

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes: Planting and maintenance as indicated on the drawings and specified herein.

1.02 PERFORMANCE REQUIREMENTS

- A. Control: The selection of herbicides, application rates and methods are to be performed under the control and guidance of a licensed pest control advisor and applicator in the State of California.

1.03 QUALITY ASSURANCE

- A. Provide laboratory soils analysis conforming to the following:
 - 1. Submit the following soils samples to the laboratory at the commencement of work:
 - a. One representative sample of native soil to be landscaped – south site.
 - 2. Place each sample in a sturdy container, properly identified, labeled, and dated.
 - 3. Provide report of results to the Owner's Representative, the Architect, and Contractor. The test shall include a fertility and suitability analysis with written recommendations for soil preparation, backfill mix, auger hole requirements, maintenance and post-maintenance fertilizer requirements. The results of this test shall supersede the amendment and fertilizer schedule specified herein and no planting shall be done until the Architect approves the soils test recommendations.
- B. Testing services shall be paid for by the Contractor.

1.04 FIELD CONDITIONS

- A. Scaled dimensions are approximate. Check and verify site dimensions and receive Owner's Representatives approval prior to proceeding with work under this section.
- B. Coordinate installation of plant materials, to avoid interference with other construction.
- C. Maintain premises clean and free of excess equipment, materials and debris incidental to work.
- D. Protect existing facilities and work of others at times in performance of work.
- E. Carefully note all finish grades before commencing work. Restore finish grade changed during course of this work to original or intended grades.

1.05 QUALITY ASSURANCE

- A. Inspections: Plants shall be subject to inspection and acceptance at place of growth or upon delivery to the site, for quality, size and variety. Such acceptance shall not impair the right of inspection and rejection at a later time or during progress of work, for size, condition of root ball, and latent defects or injuries. Immediately remove rejected plant from the site. Trees, 24 inch box size and larger, shall be accepted by Owner's representative prior to delivery.
- B. The following inspections shall be made by Owner's representative. Request inspection in writing at least two working days in advance of the time inspection is required.
- C. Inspections will be required for the following parts of work:
 - 1. Attend pre-construction meeting with General Contractor and Inspector.
 - 2. Irrigation Performance/ Soil Preparation/ Fine Grading.
 - 3. Plant material placement prior to installation.
 - 4. Preparation of Punch List prior to maintenance period.
 - 5. Final observation for completion.
- D. The Contractor, or his authorized representative, shall be on site at the time of each inspection.
- E. If Contractor requests an inspection and the site is not found to be in an acceptable condition to hold the inspection, the hourly fees of the personnel called for the inspection shall be paid by the Contractor. No site visits will be scheduled until these fees have been paid.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Submit at time of delivery invoice statements certifying quantities by bulk and/or weight, for all organic amendments and fertilizers. Submit suppliers' certificates of compliance with these specifications. Random samples may be taken by Owner's representative for analysis.

1.07 GUARANTEE AND REPLACEMENT

- A. Plantings: Guarantee planting until end of maintenance period and acceptance. Replace trees or plants that die or lose form and size as originally specified even though they have taken root and are growing after the dieback or loss of form or size.
- B. Trees: Guarantee 15 gallon trees and larger, in writing, to live in a healthy condition for one year after planting. Replace dead or unhealthy trees immediately. Replacements, including planting, staking, training, etc., shall be as originally specified, without cost to the Owner.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Provide materials of best quality obtainable, which comply strictly with Drawings and specifications.

2.02 SOIL AMENDMENTS

- A. Organic Amendment: Derived from wood or bark, granular in nature, stabilized with nitrogen and fortified with minerals, and having the following properties:
 - 1. Organic Content: Minimum 90% by weight.
 - 2. Particle Size:
 - Minimum 95% passing 4 mesh screen.
 - Minimum 80% passing 8 mesh screen.
 - 3. Nitrogen Content: 0.5% based on dry weight for redwood sawdust. 0.7% based on dry weight for fir sawdust. 1.0% based on dry weight for fir or pine bark. NOTE: Pine sawdust is not acceptable.
 - 4. Mineralized: 0.1% total iron.
 - 5. Salinity: Maximum conductivity 3.5 mm/cm at 25 degrees C.
- B. Fertilizer and Minerals:
 - 1. Soil sulfur: Minimum 95% elemental sulfur.
 - 2. Ferric Sulfate: $\text{Fe}_2(\text{SO}_4)_3$ minimum 20% Fe, as metallic.
 - 3. Commercial Fertilizer:
 - 38-0-0 Urea formaldehyde (Soil preparation)
 - 12-12-12 (Soil preparation)
 - Ammonium sulfate 21-0-0 (Weed abatement)
 - 16-6-8 (Maintenance)
 - 4. Planting Tablets: Gro-Power 12-8-8 slow release tablets.
 - 5. Gro-Power Plus: 5:3:1, 50% humus, 2% soil penetrant PH 4.5 - 4.7

2.03 PLANT MATERIALS

- A. Quantity and size of plants as stated on the Plans and Plant List. No root bound materials allowed. Plants shall be fresh and vigorous, of normal growth, and free of diseases, weeds, harmful insects, or their insect eggs and larvae.
- B. Plants are subject to inspection for approval or rejection at place of growth and/or on project site at any time before or during progress of work for size, variety, condition, latent defects and injuries. Remove rejected plants from site immediately and replace with approved plants.
 - 1. Protection: Protect plants from damaging sun and wind. Damage will be cause for rejection even after initial approval.
 - 2. Substitutes: Not permitted unless specifically approved in writing.
 - 3. Nomenclature: Conforms to customary nursery usage.
 - 4. Quantities: Provide materials as needed to complete indicated work.

2.04 STAKING AND GUYING MATERIALS

- A. Tree Stakes: Sound treated pine and uniform size, dimension and diameter, pointed at one end. Stake as detailed.
- B. Ties: 10 gauge zinc-coated iron wire, solid core with 3/8-inch diameter minimum new reinforced garden hose in a 6-inch diameter loop around tree. Secure to tree as detailed.

2.05 ROOT BARRIER

- A. Refer to section 32 91 20 for material specification.

PART 3 - EXECUTION

3.01 PRELIMINARY GRADING

- A. General: Do not work soil when the moisture content is so great that excessive compaction will occur, nor when it is so dry that dust will form or that clods will not break readily. Apply water if necessary to provide ideal moisture content for tilling and planting. Perform preliminary grading in such a way as to anticipate the finish grade after the installation of soil conditioners.
Remove or redistribute excess soil before application of soil amendments.
- B. Finish: Grade planting areas to a level of 2 inches below the adjacent pavement surface. Where no grades are shown, grade between existing or fixed controls (such as walks, curbs, catch basins) and elevations shown to provide a smooth and continual plane. Rake and level as necessary to obtain true and even surfaces. Verify all swales on Engineer's Plan, and grade to drain.
- C. Remove and dispose of rocks over 1 inch diameter within top 12 inches of soil, construction debris, weeds, etc. within the limits of the project prior to applying soil amendments.

3.02 BACKFILL MIX

- A. Stockpile a sufficient quantity of approved soil found on site, free of weeds and debris, for mixing as backfill material.
- B. Supplement on-site soil with approved import soil, as required. Mix amount for 10 cubic yards as follows: The following amendments are for Bidding purposes only. Actual quantities and mixes shall be determined in accordance with the Soils Report obtained per Item 1.03 above.
 - 6 cubic yards on-site soil
 - 4 cubic yards organic amendment
 - 20 pounds ferric sulfate
 - 10 pounds 12-12-12
 - 180 pounds 'Grow-Power Plus'
- C. Use care not to stain concrete with ferric sulfate. Cleaning of stained concrete is responsibility of Contractor.

3.03 WEED ERADICATION

- A. Perform the following procedures for irrigated planting areas:
 - 1. Spot spray perennial weeds with a non-selective systemic contact herbicide. "Round-Up" or equivalent.
 - 2. Manually remove remaining covers and weeds, and dispose off-site.
 - 3. Fertilize planting areas with Ammonium Sulfate at 4 lbs./1000 s.f. or equivalent fertilizer to promote re-growth.
 - 4. Apply irrigation at a rate sufficient to promote weed growth for a period of 2 to 3 weeks.
 - 5. When weed seeds have germinated and grown to a height of 2 inches, discontinue irrigation for a period of three (3) days to prepare the areas for

- access.
- 6. Spray weeds with a non-selective contact herbicide, and spray Bermuda Grass and Morning Glory with a non-selective systemic herbicide. Apply no water for a minimum of four (4) days following application of contact weed killer.
- 7. Allow a sufficient period of time to ensure that weeds are dead. Follow herbicide manufacturer's directions.
- 8. Lightly irrigate planting areas for a period of 2 to 3 weeks, without causing erosion of soils.
- 9. Spot spray weed re-growth with non-selective contact herbicide.
- 10. Plant container stock (no rooted cuttings).
- 11. Evenly distribute specified soil amendments to areas.

3.04 PLANTING

- A. Pre-Plant Approvals: Obtain approval of planting holes, pre-mixed backfill, plants, and locations prior to planting.
 - 1. Trees and shrubs shall not be planted until construction work in the area has been completed, final grades established, and the planting areas properly graded and prepared.
 - 2. Stake plant locations or place approved quantities of plants in containers on locations. Secure approval before excavating pits, making necessary adjustments as directed.

3.05 INSTALLATION

- A. Plant materials as soon as site is available and weather conditions are suitable. Do not plant when weather conditions are unfavorable to do good work, or if soil is excessively wet. Protect plants from sun, wind and rain at all times prior to and during planting.
 - 1. Excavate pits with scarified vertical sides and bottom, no smaller than the following sizes:
 - 1 Gallon plants - 8" deep, 12" in diameter
 - 5 Gallon plants - 12" deep, 24" in diameter
 - 15 Gallon plants - 18" in diameter
 - Boxed Trees - depth of root ball 24" wider than root ball
 - 2. Partially refill hole to a height that when a plant is placed, the crown is slightly above the finished grade. Use friable un-amended soil for all boxed trees, specified backfill mix for other container plants, and tamp to compact.
 - 3. Fill hole with water prior to installing plant.
 - 4. Deposit Gro-Power 12-8-8 tablets in plant pits as described in planting notes.
 - 5. Set plants in center of pits in vertical position so that the crown of plant is slightly above the finished grade, and backfill with prepared backfill mix.
 - 6. Form shallow basin around edge of plant ball by depressing soil slightly below finished grade. Form basin rims. Keep basin within outer edges of plant ball.
 - 7. Individually hand water each plant to saturate root ball and adjacent soil immediately after planting.
 - 8. Adjust for settlement and grade areas around plants to finish grades and dispose of excess soil.
 - 9. Stake trees designated with stake or stakes on windward side of tree as detailed.
- B. Irrigation: A sprinkler system is provided in areas for maintaining general moisture

requirements. Hand watering of newly planted trees and shrubs will; however, be required once every week for three weeks. Check plants for adequate moisture at the roots. Water as required throughout the maintenance period.

3.06 MAINTENANCE

- A. Maintenance shall begin immediately after each plant is planted, and shall continue for at least 90 days after acceptance of complete of landscaping and irrigation and as much longer as is necessary to establish thriving plants.
- B. Responsibilities: The complete maintenance of the landscape installation on site including, but not limited to, the following:
 - 1. Irrigation:
 - a. Review existing system with District personnel for satisfactory operation and coverage.
 - b. Properly and completely maintain irrigation systems, clean lines, valves, heads and other portions of such systems to assure their continual proper operations. Lubricate as needed.
 - c. Make adjustments necessary to avoid overspray onto buildings and pavements.
 - d. Program controller on a weekly basis considering weather, the water requirements of each sectional valve, and the application rate each area is capable of receiving, without runoff.
 - e. Coordinate irrigation activities with District personnel. Specify programming and shut down for repairs.
- C. Planting
 - 1. Fertilization: Apply 6 pounds per 1,000 square feet of 16-6-8 commercial fertilizer to planting areas 20 and 50 days after planting.
 - 2. Cultivation and Weeding: After period of more or less continuous watering, during which soil moisture is maintained at near saturation point, cultivate all ground cover areas by scarifying the surface 1 inch. Do not change grade, remove basins or berms in the process of such cultivation. Follow the cultivating by a period of non-irrigation, to aid the killing off of weeds, and soil aeration.
 - 3. Pruning and Staking: Unless otherwise directed, prune only to remove dead or broken branches of trees or shrubs. Re-stake, re-align and re-tie all trees as necessary.
 - 4. Insect Management: Examine all plants frequently, especially any which are subject to common insect depredation such as aphids, meanly bugs, ants, etc., to establish need for counter measures. Wash foliage with strong streams of water. Notify the Owner's representative if further measures seem warranted.
 - 5. Replacement: Immediately replace and plant materials which for reason are damaged or die during the maintenance period. Replace as originally specified.
 - 6. Protection: Protect planting against damage, including erosion, rodents, and trespass, providing proper safeguards as needed. Repair damage to the work made by pedestrians, animals, vehicular traffic, or other cause until acceptance.

3.07 CLEANING

- A. Upon completion of construction, and before final acceptance, broom-clean the entire area within the contract limits. Remove tools, surplus materials, equipment, debris, etc. and leave the site in a neat and acceptable condition.

B. Paved Areas: Clean paved areas of debris or silt by sweeping and hosing.

3.08 SITE REVIEW

A. Final review (to insure that fire department appliances are not obstructed) of all planting will be made at the conclusion of the maintenance period. Submit written notice to Owner's Representative at least 7 days before acceptance date.

END OF SECTION

SECTION 32 91 20

ROOT CONTROL BARRIER

PART 1 - GENERAL

1.01 SCOPE:

- A. This is a materials specification covering root control barrier in trenches, alongside hardscape structures such as sidewalks, curbing, pavements, concrete and building foundations to prevent structural damage due to root penetration. The product functions to provide both a physical and chemical barrier zone to restrict vegetative root encroachment.
- B. This is a material purchasing specification and design review of its use is recommended.

1.02 REFERENCED STANDARDS:

- A. *ASTM Standards
 - D4355 Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus.
 - D4491 Test Method for Water Permeability of Geotextiles by Permittivity
 - D4533 Test Method for Trapezoid Tearing Strength of Geotextiles
 - D4632 Test Method for Grab Breaking Load and Elongation of Geotextiles
 - D4751 Test Method for Determining the Apparent Opening Size of a Geotextile
 - D4833 Test Method for Index Puncture Resistance of Geomembranes and Related Products
 - D5261 Test Method for Measuring Mass per Unit Area of Geotextiles
- B. *EPA Standards (Reference EPA Label)
 - Registration No. 59823-1 (Attached Exhibit B)
 - EPA CG 1500 Water Solubility
 - EPA CG 1600 Vapor Pressure

PART 2 - MATERIALS

2.01 PHYSICAL AND CHEMICAL REQUIREMENTS

- A. Fibers used in the manufacture of root control barrier substrate fabric shall consist of long chain synthetic polyolefins (at least 95% by weight) and a UV stabilizer. They shall be formed into a stable network such that the filaments or yarns retain their dimensional stability relative to each other.
- B. Nodules consisting of trifluralin, carbon black, and polyethylene compounded in a patented method utilizing time-released characteristics are permanently attached to the substrate fabric on 1-1/2" centers by a through injection molding process.
- C. All substrate property values, with the exception of apparent opening size (AOS), in these specifications represent minimum average roll values (MARV) in the weakest principal direction (i.e., average test results of any roll in a lot sampled for conformance or quality assurance testing shall meet or exceed the minimum values provided herein). Values for AOS represent maximum average roll values.

- D. Property values for the trifluralin are average run values.

PART 3 - INSTALLATION

3.01 CERIFICATION

- A. The Manufacturer shall provide to the Engineer a certificate stating the name, product name, style number, chemical composition and other pertinent information to fully describe the product. The Manufacturer is responsible for establishing and maintaining a quality control program to assure compliance with the requirements of the specification. Documentation describing the quality control program shall be made available upon request.
- B. The Manufacturer's certificate shall state that the root control product meets requirements of the specification as evaluated under the Manufacturer's quality control program. The certificate shall be attested to by a person having legal authority to bind the Manufacturer.
- C. Either mislabeling or misrepresentation of materials shall be reason to reject those products.

3.02 SAMPLING, TESTING, AND ACCEPTANCE

- A. Root control substrate product shall be subject to sampling and testing to verify conformance with this specification. Acceptance shall be based on manufacturer's certifications.
- B. Testing shall be performed in accordance with the methods referenced in this specification for the indicated application. The number of specimens to test per sample is specified by each test method.

3.03 SHIPMENTS AND STORAGE:

- A. Product labels shall clearly show the manufacturer or supplier name, style number, and roll number and shall include a compliance statement certifying that all ingredients and inspection standards for this product have been met.
- B. Each root control product roll shall be wrapped with a protective EVOH bag and placed in a box that will protect the product from damage due to shipment, water, sunlight, and contaminants and to prevent premature release of herbicide. The protective wrapping shall be maintained during periods of shipment and storage.
- C. During storage, root control product shall be elevated off the ground and out of direct sunlight. It shall remain sealed in EVOH protective bag inside shipping box at a temperature of not more than 110°F.

3.04 PRODUCT DESCRIPTION:

A. Overall Product Major Composition and Ingredients

Active Chemical*:	Trifluralin (a,a,a-Trifluro 2, 6-dinitro-N, N, -Dipropyl-p -toluidine)
17.5%	
Inert Ingredients:	100% Spunbonded Polypropylene, Polyethylene and Carbon
82.5%	

Typical Values			
Trifluralin Characteristics Method*	English	Metric	Test
Vapor pressure (mm Hg @ 25 ° C)	1x10-4	1x10-4	EPA CG 1600
Solubility in Water (ppm @ 25 ° C)	<0.3	<0.3	EPA CG 1500
Minimum Values			
Fabric Properties	English	Metric	Test Method*
Unit Weight	3.9 oz/yd ¹	130 g/m ²	ASTM D5261
Grab Tensile Strength	130 lbs	575 N	ASTM D4632
Elongation at Break	60%	60%	ASTM D4632
Puncture Strength	40 lbs	175 N	ASTM D4833
Trap Tear	60 lbs	265 N	ASTM D4533
Permittivity	0.7 sec	0.7 sec.	ASTM D4491
AOS (Max Value)	0.21 mm	0.21 mm	ASTM D4751
Ultraviolet Stability	70% @ 500 hrs	70% @ 500 hrs	ASTM D4355

* Test methods or revision numbers available on request (17.5% Average trifluralin in total composite, Min. of 20% trifluralin in nodules)

¹ Available from ASTM, 1916 Race Street, Philadelphia, PA

² Available from ASTM, 1916 Race Street, Philadelphia, PA

END OF SECTION

SECTION 33 10 00

WATER UTILITIES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Site domestic water, and fire water service piping and appurtenances from the source of potable water to a point 5 feet outside the building.
- B. Related Work:
 - 1. Site drainage systems
 - 2. Sanitary sewer system
 - 3. Earthwork, trenching and backfilling
- C. Perform work on water mains, fittings, appurtenances, fire hydrants, meters, and related items within the easement to be granted to local Water District "General Specifications and Special Conditions" and "Standard Drawings", current edition. Purchase one set of these documents from the District Office to be maintained on the site for the duration of the work.

1.02 REFERENCED STANDARDS

- A. Perform work except as noted in accordance with applicable provisions of "California Plumbing Code" (CPC), 2013 Edition, and 2013 California Amendments, International Association of Plumbing and Mechanical Officials (IAPMO), Los Angeles, California.
- B. Underground conduit construction shall be in accordance with Section 306 of "Standard Specifications for Public Works Construction" (PWC Spec.), Current Edition, published by Public Works Standards, Inc. (PWSI), Los Angeles, California.

1.03 SUBMITTALS

- A. Procedures: Comply with requirements of Section 01 33 00 – Submittal Procedures.
- B. Submittals: List of materials proposed for use accompanied by manufacturer's latest printed literature with technical data.
- C. Certificates: Submit manufacturer's certification that materials meet specified requirements.
- D. Record Drawings: Provide in accordance with Section 01 78 39 – Project Record Documents, and completion of water service installation.

1.04 QUALITY ASSURANCE

- A. Prior to final acceptance of the work obtain acceptance of the work from the serving utility and submit copies of the Certificates of Completion to the Inspector for forwarding to the Owner.

1.05 SEQUENCING OF LAND SCHEDULING

- A. Install utility mains as soon as conditions permit other facilities and improvements to follow.
- B. Make installation of fire hydrants and water service laterals for meters and after construction of Portland cement concrete curbs unless otherwise shown on the drawings. Install water gate valve boxes and covers, and adjust to finished grade following completion of the asphaltic concrete pavement.
- C. Install tops of manholes, junction chambers, vaults, boxes, and valve boxes unless otherwise indicated on Drawings, to an elevation 3 inches below rough grade and raise to final elevation after paving.
- D. Coordinate with connections to public water main and to interior water distribution piping.

PART 2 - PRODUCTS

2.01 WATER SYSTEMS COMPONENTS

- A. Water pipe shall be polyvinylchloride (PVC), ANSI/AWWA C900 or ANSI/AWWA C905, 4" or larger.
- B. PVC Schedule 80, Type I Grade I, with a Cell Classification of 12454 as defined in ASTM D1784 for pipes 1" to 3 ½".
- B. Gate Valves:
 - 1. Provide iron body, bronze mounted, parallel seat, double disc, non-rising stem, bottom or side wedging, and complying with AWWA C500-09 Specifications.
 - 2. Provide 12 inch and smaller with a working pressure of 200 p.s.i. The working pressure and the name of the manufacturer shall be cast in plain letters on the body of the valve.
 - 3. Open by turning counterclockwise.
 - 4. Entire wedging mechanism shall be solid bronze and allow the gates to function properly when water pressure is exerted from either or both directions.
 - 5. Equip valves with flanged or threaded ends.
 - 6. Valve stems shall be solid bronze.
 - 7. Stem nuts shall be solid bronze.
 - 8. Cast or rolled bronze used in the manufacture of gate valves shall contain a zinc content of not in excess of 5 percent and an aluminum content not in excess of 2 percent.
- D. Meter and Detector Check Assemblies: In accordance with local Water District requirements. Detector check assemblies shall be reduced pressure principal backflows only.

- E. Fire Hydrants: Conform to local Water District requirements. Minimum requirements shall be a wet barrel style with a minimum of one 2 ½" and one 4" outlet. The 4" outlet shall face the fire department access road. All outlets shall be provided with National Standard Threads (NST).
- F. Post indicators shall be UL listed.
- G. The outlets of fire hydrants shall be inspected and approved by the Fire Department. A field coat of paint shall be applied to hydrants after installation.
- H. Check Valves: Swing type spring loaded for 200 p.s.i.g. working pressure, set readily and tightly with the face of the closure elements made of a non-corrodible material such as bronze composition conforming to ASTM B62.
- I. Valve Boxes: Cast iron, slip adjustment type of appropriate size for valve and shall be Alhambra, No. A-3009 or approved equal. Each valve box cover shall have "Water" cast in the top using sharp-faced letters of 1 inch minimum height.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify drawing dimensions with actual field conditions. Inspect related work and adjacent surfaces. Report to Architect conditions which prevent proper execution of this work.

3.02 PREPARATION

- A. Excavate and construct trenches and manholes or other structures forming a part of the pipeline. Trench excavation shall conform to the requirements of Section 31 20 00 – Earth Moving, and shall require the approval of the Soils Engineer.

3.03 CONNECTIONS TO EXISTING MAINS

- A. Where connections are made between new work and existing mains, the connections shall be made by using special couplings (such as Rockwell Clamp and Coupling-Tapping Sleeves, or approved equal), and other fittings to suit the actual conditions. Methods of connections to existing mains shall be as required by local codes.

3.04 PIPE INSTALLATION

- A. Survey Line and Grade: Provide grade controls and survey lines in accordance with Section 01 50 00, Temporary Facilities and Controls.
- B. Pipe Installation: Pipe will be inspected in the field by the Inspector before and after laying. Corrective work shall be approved by the Inspector at no cost to the Owner. Installation of pipe shall conform to the requirements of Section 306-1.2 of the Standard
- C. Backfill and Compaction: Perform in accordance with Section 306-1.3 of the Standard Specifications. In backfilling the trench take necessary precautions to protect the pipe from damage to shifting. Depth of cover minimum 36 inches.

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- D. Install concrete thrust blocks against undisturbed soil at bends, tees, crosses, valves, pipe ends and where changes in pipe diameters occur at reducers or in fittings. Also, install thrust blocks at valves 12 inches or larger when installed with rubber gasket joints. Thrust blocks shall be class 420-C-2000 Portland cement concrete, per drawings.
- E. Underground mains and lead-in connections to system risers shall be completely flushed before connection is made to any overhead sprinkler piping. Where underground piping is flushed and not immediately connected to the overhead piping, the riser shall be capped or otherwise protected to prevent debris, dirt, or animals from entering into the underground piping. This must be witnessed by the project inspector.
- F. Contractor shall provide a completed signed copy of the "Contractor's Materials and Test Certificate for Underground Piping", per NFPA 13, Figure 10.10.1.
- G. All piping and attached appurtenances subjected to a system working pressure shall be hydrostatically tested at 200 psi, or 50 psi in excess of the system working pressure, whichever is greater, and shall maintain that pressure without loss for 2 hours. If a connection is being made to an existing system, it is the contractor's responsibility to locate all shut off valves, PIV's and any other device that will inhibit the correct execution of the test or potentially damage any existing systems.
- H. A waterflow alarm test shall be conducted and approved by the Project Inspector in accordance with NFPA 13, Sec. 24.2.3.1. An alarm must sound within 5 minutes for local alarm bell.
- I. Inspections are required prior to pouring thrust blocks, hydrostatic testing and during flushing.
- J. Installation, inspection, and testing shall conform to 2010 NFPA 13, and 2010 NFPA 24.
- K. Unless otherwise approved by DSA, all fire piping shall be a minimum of 6" in diameter. The lowest operating nut shall be a minimum of 18" above grade and the hydrant flange shall be a minimum of 2" above grade. Hydrant flange shall not be more than 4" above grade.
- L. Fire hydrants shall be a minimum of 40-feet from all structures. A keyed gate valve shall be provided for each hydrant.
- M. All ferrous pipe and fittings shall be protected with loose 8 mil polyethylene tube. The ends of the tube and any splices made for T's or other piping components shall be sealed with 2" tape, approved for underground use. All bolted joints shall be cleaned and thoroughly coated with asphalt or other corrosion retarding material after assembly and prior to poly-tube installation.
- N. A 12" bed of clean fill sand shall be provided below and above the pipe (24" total). Sand shall be compacted to 90% of ASTM 1557 modified.
- O. All bolts used for underground connections shall be stainless steel.
- P. Pipe sections between appurtenances and joints shall be backfilled during hydrostatic testing to prevent movement.
- Q. All private hydrants, sprinkler control valves, detector check assemblies, post indicating valves, and fire department connections shall be painted OSIIA Red.

- R. All control valves shall be locked in the open position. Valves shall be monitored if they serve 100 or more sprinkler heads.

3.05 FIELD QUALITY CONTROL

- A. Testing of Pipelines: Perform tests required by governing agencies. Testing shall be performed in accordance with Section 306-1.4 of Standard Specifications. Furnish water, materials and labor for making the required tests. Tests shall be made in the presence of the Inspector. Notify the Inspector at least 48 hours before performing the required tests.

3.06 CLEANING

- A. Upon completion of work, leave the site clean and clear of debris and construction materials, and as specified in Section 01 74 00 – Cleaning and Waste Management.

END OF SECTION

SECTION 33 13 00

DISINFECTING OF WATER UTILITY DISTRIBUTION

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section includes the furnishing of all labor and materials for disinfection of the potable water system. Potable water systems are those systems which carry domestic water from the supply main without isolation of the branch by a backflow prevention device. Install all plumbing fittings and valves necessary to perform the disinfection.
- B. This section also includes the furnishing of all labor and materials to sample water in system following completion of procedure and provide bacteriological analysis of the water.

1.02 QUALIFICATIONS:

- A. Disinfection: Disinfection shall be done by a commercial disinfection company approved by the School District. Submit to the School District's Representative the name of the proposed company for approval.
- B. Bacteriological Analysis: Water testing shall be done by a laboratory approved by the State Department of Health Services. Submit for approval the name of the proposed laboratory as well as the proposed number and location of samples.
- C. Provide a certificate of completion per Part B attached standard chlorination report which denotes the lines disinfected, the concentration applied and the amount and type of disinfection agent used, and that disinfection is in accordance with AWWA C601 and State Health Department requirements.

PART 2 - MATERIALS

2.01 MATERIALS

- A. Use an approved chlorine agent, applied in liquid form into the system being disinfected. Chlorine gas or a hypochlorite solution may be used to make up the disinfecting liquid.

PART 3 - EXECUTION

3.01 PRELIMINARY PREPARATION OF THE SYSTEM:

- A. Provide within 3 feet of the supply main, an injection port for introducing the chlorine solution and a gate valve upstream from the injection port.
- B. There shall be no dead-end sections in the system exceeding 3 feet in length. All branches within the system shall lead to an outlet for bleeding and flushing.
- C. After final pressure tests, open each fixture or outlet to maximum flow and run until the discharge water is free from particulates.

3.02 CHLORINATION PROCEDURE:

- A. Notify the School District's Representative at least five working days prior to the start date of chlorination per Part A attached chlorination report.
- B. Install all fixtures to be served by the potable water system before start of chlorination.
- C. Prior to injection, place signs on each fixture being treated, reading "Heavily Chlorinated Water - Do Not Use."
- D. Introduce the chlorine into the supply stream at a rate to provide a uniform concentration of chlorine in the entire system. Maintain at least 50 ppm chlorine level at each fixture after a hold period of 24 hours. Do not exceed 150 ppm at any time.
- E. Draw the injected chlorine in the system through each outlet and fixture until the specified concentration level is reached. Then close all valves including the service cock and supply valve. Keep the system closed during the 24 hour hold period.
- F. The School District will require a test for the residual concentration in the system at the end of 24 hours. Release no water from the system until these required samples are taken. A minimum concentration of 50 ppm of chlorine is required at all chosen sampling points.
- G. After approval to proceed, flush the system at a relatively high velocity to remove the injected chlorine to a concentration in the system of no more than 0.5 ppm above that in the normal supply.
- H. After approval to proceed, secure the entire system for at least three days prior to taking samples for bacteriological analysis.

3.03 SAMPLING AND NOTIFICATION:

- A. At the completion of the three day hold period, take bacteriological water samples with observation by the School District's Representative.
- B. Sample bottles must be provided by the approved laboratory. After the samples have been collected, the School District's Representative may allow temporary use of the water system pending results of the bacteriological analysis of the samples. The system cannot be used unless such allowance in writing is given.
- C. Upon completion of sampling, submit the certificate of completion to the School District Representative for approval.

3.04 ANALYSIS:

- A. Perform qualitative and quantitative bacterial analysis on the water samples and submit a laboratory report. The report must include the presence of any E. Coli bacteria in a 100 ml sample (this must be negative to be acceptable) and a total plate count of bacteria per cc of the sample (this must be less than 100, or equal to the supply).

3.05 FINAL ACCEPTANCE:

- A. Upon satisfactory completion of all procedures and receipt of acceptable bacteriological results, written approval of the system will be provided by the School District's Representative per Part C attached standard chlorination report. Failure to fully comply with the above procedures will result in a requirement to repeat the procedure until acceptable results are achieved, at no additional cost to the School District.

END OF SECTION

SECTION 33 40 00

STORM DRAINAGE SYSTEMS

PART 1 - GENERAL

All applicable portions of Division 1, including the drawings and general provisions of the contract, the general and supplementary conditions and Division 1 specifications sections which apply to work of this section as if printed herein.

1.1 WORK INCLUDED:

1.1.1 Work includes storm drain lines and related storm drain structures.

1.2 RELATED WORK:

1.2.1 Related Work Specified Elsewhere:

1.2.1.1 Section 017123 - Field Engineering: Location, elevations and inverts of storm drainage lines and structures.

1.2.1.2 Section 312200 - Earthwork.

1.2.1.3 Section 312300 – Excavating and Backfilling for Utilities

1.2.1.4 Section 15400 - Plumbing Systems: Roof drainage piping within five feet of building lines.

1.3 QUALITY ASSURANCE:

1.3.1 Regulatory Requirements:

1.3.1.1 Comply with applicable codes and regulations of governmental agencies having jurisdiction.

1.3.1.2 Where requirements of applicable codes, regulations and standards conflict with this Specification, comply with the more stringent provisions.

1.3.2 Source Quality Control:

1.3.2.1 Tests: Materials for which physical characteristics have been stipulated shall have had such characteristics independently confirmed by laboratory tests employing industry-recognized procedures. Both the laboratory performing the tests and the test methods employed will be subject to the approval of the Architect.

1.4 REFERENCES:

1.4.1 American Society for Testing and Materials (ASTM):

1.4.1.1 C 412 - Specifications for Extra Strength Clay Pipe.

1.4.1.2 C 478 - Specifications for Precast Reinforced Concrete Manhole Sections.

1.4.1.3 C 139 - Specifications for Concrete Masonry Units for Construction of Catch Basins and Manholes.

1.5 SUBMITTALS:

1.5.1 Product Data: Submit complete manufacturer's description literature and specifications in accordance with the provisions of Section 013300.

1.5.1.1 Materials List: Submit complete lists of materials proposed for use, giving the manufacturer's name, catalog number, and catalog cut for each item where applicable.

1.5.2 Shop Drawings: Submit in accordance with Section 013300 for approval for all frames, grates, manholes and manhole steps, catch basins, inlets, pipe materials and joints.

1.6 DELIVERY, STORAGE, AND HANDLING:

1.6.1 Protection: Use all means necessary to protect the materials of this Section before, during, and after installation.

PART 2 - PRODUCTS

2.1 MATERIALS:

2.1.1 Storm Sewer Pipe:

2.1.1.1 Corrugated PE Pipe and Fittings NPS 10 and smaller: AASHTO M 252M, Type S, with smooth waterway for coupling joints.

2.1.1.1.2 Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings to form silttight joints.

2.1.1.2 Corrugated PE Pipe and Fittings NPS 12 to NPS 48: AASHTO M 294, Type S, with smooth waterway for coupling joints.

2.1.1.2.2 Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings to form silttight joints

2.1.1.3 PVC Sewer Pipe and Fittings: NPS 15 and Smaller: ASTM D 3034, SDR 35, for solvent-cemented or gasketed joints.

2.1.1.3.1 Gaskets: ASTM F 477, elastomeric seals.

2.1.1.3 All storm sewer systems to have water tight seals.

2.1.2 Bedding Material For Storm Sewer: In accordance with Section 312300 Excavation and Backfill for Utilities.

2.2 UTILITY STRUCTURES:

2.2.1 New storm utility structures shall be constructed as detailed on the Drawings and be one of the following:

2.2.1.1 Precast reinforced concrete manhole riser sections conforming to ASTM C 478.

- 2.2.1.2 Cast-in-place concrete of 3,000 psi strength. Concrete used for utility structures shall conform to requirements specified in Section 033000.
 - 2.2.2 Mortar for jointing precast-segmental masonry units and joining sewer to new storm manholes shall be Type S and consist of one part Portland cement to one part plaster sand, mixed with the least amount of clean water necessary to provide a workable mortar. Mortar shall meet requirements of ASTM C 387.
 - 2.2.3 Concrete Fill for Benching Manhole Structures: Concrete shall be mixed with the least amount of clean water and shall have a minimum strength of 3,000 psi and conform to ASTM C 387.
 - 2.2.4 Steps for New Storm Sewer Manhole Concrete Structures: Cast iron conforming to ASTM A 48 or hot-dipped galvanized steel bar or as detailed on the drawings. Provide steps on storm manholes where the invert is 2 feet or more from the bottom of the cast iron frame. All manholes shall be manufactured and installed per local or county codes and regulations. All manhole covers to be flush with grade.
 - 2.2.5 Cast Iron Frames, Grates and Covers for Storm Sewer Structures: Gray cast iron castings conforming to ASTM A 48 and be of type and configuration as noted or detailed. All grates and covers shall be painted if located in a concrete walkway. Color as selected by the Architect. Grates maximum openings within a walkway or paved area shall be 1/2 inch wide. Perpendicular to path of travel CBC 1133B.7.2.
- 2.3 CATCH BASINS
- 2.3.1 Standard Precast Concrete Catch Basins: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
 - 2.3.1.1 Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
 - 2.3.1.2 Riser Sections: 4-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.
 - 2.3.1.3 Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
 - 2.3.1.4 Joint Sealant: ASTM C 990, bitumen or butyl rubber.
 - 2.3.1.5 Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
 - 2.3.1.6 Grade Rings: Include 2 or 3 reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch- diameter frame and grate.
 - 2.3.1.7 Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

PART 3 - EXECUTION

3.1 INSPECTION:

- 3.1.1 Prior to Work of this Section, carefully inspect Work of all other trades and verify that such work is complete to the point where this installation may properly commence.
- 3.1.2 Verify that work of this Section may be installed in accordance with all pertinent codes and regulations, the original design, and the referenced standards.

3.2 PREPARATION:

- 3.2.1 Field Measurements: Lay out and stake all storm sewer piping at 25 foot intervals at all structures, ends of pipe, etc., before starting excavation.
- 3.2.2 Protection: Protect the installed work and materials of all other trades which may be affected by work of this Section.

3.3 INSTALLATION:

- 3.3.1 Excavating and Backfilling for Storm Sewer System: Excavate, trench and backfill in accordance with Section 312300. Trenches under parking areas, sidewalks, etc., shall be entirely backfilled with selected granular material only.
 - 3.3.1.1 Provide and maintain sufficient barricades and warning devices adjacent to excavation to safeguard against injury to workmen and the public at all times.
 - 3.3.1.2 After installation of piping and equipment have been completed, backfill all excavations in accordance with Section 312300.
 - 3.3.1.3 Where excavation is necessary in existing pavement, the Contractor is required to pay all fees and permit costs of opening street or pavement and all costs of filling and repaving in accordance with requirements of and to the satisfaction of the Municipality, Utility, or other Owner of such paving.
 - 3.3.1.4 Removal of subsurface obstructions which are uncovered during excavation for installation of the utility systems specified herein shall be removed by the Contractor at his expense, up to 2 feet below the bottom of the lineal pipe run or invert of catch basins and/or drainage structures.
- 3.3.2 Bedding:
 - 3.3.2.1 Bedding for storm sewers shall be installed a minimum of 6 inches deep beneath the bottom of pipe to provide a granular cushion between the pipe and the natural soil. Refer to Section 312300 for further information.
 - 3.3.2.2 The pipe bedding shall be placed so that the entire length of the pipe will have full bearing. No blocking of any kind shall be used to adjust the pipe to grade except when used with granular bedding.
 - 3.3.2.3 Bedding backfill shall continue to a minimum of 12 inches on top of pipe, for final trench backfill.
- 3.3.3 Construction of Underground Utility Structures:
 - 3.3.3.1 All structures shall be constructed so that no water pipe is in contact with or enclosed by any part of a sewer manhole or other similar structures.
 - 3.3.3.2 Precast sections shall be sealed with mastic joint sealer. Prior to joining the sections, all gasket and pipe surfaces to be joined shall be clean and dry. All lifting holes shall be filled with mortar.

3.3.3.3 Inlet and outlet pipes for structures shall extend outside the walls a sufficient distance to allow for connections. Special care shall be taken to see that the openings through which pipes enter structures are completely sealed with mortar. The bottoms of all structures indicated on the Drawings shall be filled with 3,000 psi strength concrete and shaped to provide smooth channels from the lowest inlet pipe entering the structure to the outlet pipe.

3.3.3.4 Cast iron frames shall be accurately set in full 1 inch mortar beds to finish elevation.

3.3.3.5 Plugs and connections: When specified in Drawings, stubs or other open ends which are not to be immediately connected shall be made of an approved material and shall be secured in place.

3.3.3.6 Use commercially manufactured wyes for branch connections.

3.4 FIELD QUALITY CONTROL:

3.4.1 Tests: Upon completion of this portion of the Work, and prior to its acceptance by the Owner, make all required tests and secure all required approvals from agencies having jurisdiction.

3.4.2 Provide the Owner proof that all storm drainage and pipe, devices, flow to the main storm drain piping and no clogging occurs. If clogging occurs, the Contractor shall remove any and all debris, rocks and dirt from the clogged pipe and/or drainage structure at no cost to the Owner.

3.5 ADJUSTING AND CLEANING:

3.5.1 At the completion of the work specified herein and prior to the Owner's final acceptance, all sediment and debris shall be removed from all storm sewers and their structures.

3.5.2 Provide a camera for storm drain pipe exploration where storm drainage devices backed up or will not flow through. All camera(s), devices, film and camera exploration shall be at Contractor's expense.

END OF SECTION

SECTION 33 41 00

SANITARY SEWER AND STORM DRAINAGE PIPING (12" and below)
(THIS SPECIFICATION MUST BE MODIFIED IF PVC PIPE IN EXCESS OF 12" IS SPECIFIED FOR SANITARY OR STORM SEWER)

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. These specifications designate the requirements for the furnishing and installing underground PVC gravity pipe for storm drain and sewers.

1.02 REFERENCED STANDARDS:

- A. The editions and specifications and standards referenced herein, published by the following organizations apply to the construction only to the extent specified by the reference.
 - 1. Standard Specifications:
 - a. Standard Specifications for Public Works Construction, The Green Book, Current Edition.
 - b. Standard Special Provisions of the Regional Standards Committee.
 - c. City of San Diego Standard Specifications for Public Works Construction.
 - 2. Standard Drawings:
 - a. City of San Diego Standard Drawings, Current Edition.
 - 3. American Water Works Association (AWWA).
 - 4. UNI-BELL PVC Pipe Association (UNI).

1.03 SUBMITTALS:

- A. Submit manufacturer's catalog data on pipe to be supplied.
- B. Contractor shall provide a video tape to Project Manager after installation.

PART 2 - MATERIALS

2.01 PIPE MATERIALS

- A. POLYVINYL CHLORIDE PIPE (PVC) AND FITTINGS:
 - 1. Pipe and Fittings: Shall conform to ASTM D3034, shall be SDR 35, with ends suitable for elastomeric gasket joints. Pipe shall meet requirements of UNI-B-15-10. Main Supply lines shall be 4" minimum. Service lines shall be sized for usage.

2. Joints and Jointing Material: Utilize an integral bell and spigot with a solid cross section rubber gasket. Joints shall conform to ASTM D3212. Gaskets shall conform to ASTM F477.
 3. Clean outs: Same material as sewer pipe with a PVC threaded fitting and riser. Clean outs are to have concrete collar and be located in easily accessible locations. Clean outs shall be set flush.
 4. Pipe Stiffness: Minimum pipe stiffness (@ 5% deflect) shall be 46 for all sizes when tested in accordance with ASTM D2412.
 5. Flattening: There shall be no evidence of splitting, cracking, or breaking when the pipe is tested as follows:
 - a. Flatten specimen of pipe, six inches long between parallel plates in a suitable press until the distance between the plates is forty percent of the outside diameter of the pipe. The rate of loading shall be uniform and such that the compression is completed within two to five minutes.
 6. Products: Ringtite greenbell PVC sewer pipe, Johns-Manville, Denver, Colorado; Fluidtite PVC sewer pipe, Certainteed Corporation, Anaheim, California; or equal.
- C. Bedding – Bedding shall be 12" of sand per the Green Book, current edition.
- D. Concrete Manholes – 48 inch or 60" diameter pre-cast concrete manhole with eccentric entrance cone and grade rings as specified in the Standard Specifications of the **local Water District**. Larger manholes may be required as indicated on the Plans. Seal all manholes and water test.

PART 3 - INSTALLATION

3.01 TRENCHING AND BACKFILLING

- A. Trenching and backfilling shall be per Section 31 23 00 – Excavation and Backfill.

3.02 STORAGE OF MATERIALS:

- A. Inspect all materials delivered to the site for damage. Store materials on site in enclosures or under protective covering out of direct sunlight. Do not store materials directly on ground. Keep inside of pipes and fittings free of dirt and debris.

3.03 INSTALLING JOINTS:

- A. Apply the joint manufacturer's lubricant to the pipe spigot to assemble the joint. Follow the manufacturer's instructions. Make joints water tight and root tight.
- B. All connections to mainline shall be at a 45 degree angle, or greater.

3.04 INSTALLING THE PIPE:

- A. Install pipe in accordance with ASTM D2321, UNI-B-5-89 and the following:
1. Inspect each pipe and fitting before lowering the pipe or fitting into the trench. Clean ends of pipe thoroughly. Remove foreign matter and dirt from inside of pipe and keep clean during and after laying.
 2. Use implements, tools, and facilities for the safe and proper protection of the pipe. Handle pipe in such a manner as to avoid any physical damage to the pipe. Do not drop or dump pipe into trenches under any circumstances.
 3. When installing piping in trenches, do not deviate more than 1 inch from line or 1/4 inch from grade. Measure for grade at the pipe invert.
 4. Grade the bottom of the trench to the line and grade to which the pipe is to be laid, with allowance for pipe thickness. Remove hard spots that would prevent a uniform thickness of bedding. Before laying each section of the pipe, check the grade with a straightedge and correct any irregularities found. The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point between bell holes, except that the grade may be disturbed for the removal of lifting tackle.
 5. At the location of each joint, dig bell (joint) holes in the bottom of the trench and at the sides to permit visual inspection of the entire joint.
 6. Provide and maintain means and devices at all times to remove and dispose of all water entering the trench during the process of pipelaying. The trench shall be kept dry until the pipelaying and jointing are completed.
 7. When the pipelaying is not in progress, including the noon hours, close the open ends of pipe. Do not permit trench water, animals, or foreign material to enter the pipe.
 8. Lay pipe without break, upgrade from structure to structure, with the bell ends of the pipe upgrade.
 9. Do not use the pipe as a drain for removing water that has infiltrated into the trench.
 10. After joint assembly, bring the bedding material up to 1 foot above the top of the pipe. Place and compact the imported sand as directed in Section 31 23 00. The remainder of the backfill shall be native earth backfill, installed per Section 31 23 00.

3.05 TESTING FOR ALIGNMENT:

- A. After the pipe has been installed, tested for leakage, backfilled to existing grade, and manholes raised to grade and resurfaced, "ball" the pipe from manhole with a sewer scrubbing ball. After balling the pipe, perform the following.

- B. "Mirror" straight sewers and inlet/outlet ends of curvilinear sewers. Perform balling and mirroring in the presence of the School District's Representative to test for alignment, grade, damage or defective pipe in place, or any other type of faulty installation. Should balling and mirroring indicate any faulty installation of the pipe, repairs or replacements shall be made at the Contractor's expense.

3.06 LEAKAGE TEST (SEWER ONLY):

- A. Test for leakage by means of a water test. Test each section of pipe between manholes, along with the manholes.
- B. Even though a section may have previously passed the leakage test, test each section of sewer subsequent to the last backfill compacting operation in which heavy compaction equipment may have damaged or affected the required watertight integrity of the pipe, structure, or appurtenance.

3.07 WATER TEST (SEWER ONLY):

- A. Test each section of pipe between two successive structures by closing the lower end of the pipe to be tested and the inlet pipe of the upper structure with plugs or stoppers. Fill the pipe and structure with water to a point 4 feet above the invert of the open pipe in the upper structure, or to a height of 10 feet above the invert of the sewer in the lower structure, whichever gives the less hydrostatic pressure on the lower structure.
- B. The total leakage shall be the decrease in volume of water in the upper structure. The leakage shall not exceed 0.025 gpm per inch of nominal diameter of pipe per 1,000 feet of sewer pipe being tested. Do not use the length of lateral connections in computing the length of pipe being tested.
- C. If the leakage is greater than allowed, overhaul the pipe and, if necessary, replace and relay until the joints and pipe comply with this test. Complete tests before trench is paved.

END OF SECTION

SECTION 33 44 00

STORM WATER DRAINS (LARGER THAN 12" IN DIAMETER)

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes: Completion of storm drain lines and related storm drain structures as indicated on the Drawings and specified herein. All items in this specification must be submitted for architect's review and approval:
 - 1. Pipe Materials
 - 2. Trenching-Backfilling-Compaction
 - 3. Laying Pipe
 - 4. Drainage Structures
- B. Related Sections:
 - 1. Concrete, Section 32 16 00 – Curbs, Gutters, Sidewalks and Driveways.
 - 2. Compaction for Backfilling, Section 31 23 00 – Excavation and Fill.
 - 3. Reinforcing Steel, Section 03 20 00 – Concrete Reinforcing.
 - 4. Section 03 30 00 – Concrete.

1.02 REFERENCE STANDARDS

- A. The work specified in this section shall be performed in accordance with Section 303 and 306, latest edition of the Standard Specifications for Public Works Construction.
- B. Construction of storm sewers and appurtenances shall be in accordance with the applicable sections of the Standard Specification for Public Works Construction.
- C. Open Trench Operations: Trench excavation and backfill necessary for the installation of the storm sewerage main and appurtenances shall be done in accordance with Section 306, latest edition of the Standard Specifications for Public Works Construction, as noted in the Special Provisions.

1.03 PERFORMANCE REQUIREMENTS

- A. Storm drains shall be staked by a Land Surveyor licensed to practice in the State of California.

1.04 QUALITY ASSURANCE

- A. All catch basins and manholes and related structures and devices indicated as public agency standards shall be constructed in accordance with the standard plans and specifications of that agency.
- B. Where connections are made to existing public drainage systems, they shall be made in accordance with the instructions or specifications of the authority having jurisdiction and in the presence of a representative of that agency.

- C. Where drain lines, drainage structures, and appurtenances are constructed in public streets or rights of way, they shall be constructed in accordance with the standard plans and specification of the authority having jurisdiction and in the presence of a representative of that agency.
- D. Secure necessary permits for work performed under conditions which exist in Items above. The Owner will pay for inspection fees and permits connected therewith.
- E. Upon completion of the work, the Contractor shall provide the Architect with certified proof that the work performed is as described in Section 1.04, Items A, B, and C. above; and has been inspected, approved and accepted by the governing agency having jurisdiction.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Protection:
 - 1. The Contractor shall be responsible to furnish and maintain temporary barricades, warning lights, and other types of protection and to prevent accidental injury to the general public and personnel employed on the project.
 - 2. Provide adequate cribbing, sheathing, and shoring as necessary to safely retain the earth sides of excavations and trenches from caving and other damage resulting from excavating, together with suitable forms of protection against property damage and bodily injury to personnel employed on the work and the general public. Contractor to be responsible for the design, installation, and maintenance of required cribbing and shoring, and shall meet the approval of the Cal/OSHA and local governing agency requirements.
 - 3. Drain lines, including trenches, shall be protected from damage during the entire construction period. Be responsible to replace or rework damaged portion of the work at no cost to Owner.

PART 2 - PRODUCTS

2.01 PIPE MATERIALS

- A. Contractor's Option: The Contractor shall have the option of using reinforced concrete pipe, cast iron pipe, HDPE pipe, or polyvinylchloride pipe for those storm drain lines indicated on the drawings where no specific type is called for. Cast iron pipe shall be used where indicated and also where storm drain lines are within five feet of walls and where lines have less than 12 inches of cover. Reinforced concrete pipe shall also be used where indicated.
 - 1. Reinforced Concrete Pipe: In compliance with the American Concrete Pipe Association. Strength as indicated on the drawings, or as determined by engineer. All pipe shall be gasketed pipe creating a water tight installation.
 - 2. Cast Iron Pipe: Service weight, hubless, coated, cast iron pipe and fittings in compliance with ASTM A74-09, latest revision.

3. HDPE pipe: ADS Pro Link WT with bell/bell non-cleated coupler with O-ring gasket for 12" - 24" and non-cleated integral welded coupler with o-ring gasket for 30" and above, or equal. Joints must meet ASTM D3212 lab test and ASTM F1417 watertight field test. ADS Series 35 couplers must be used when going from HDPE pipe to PVC pipe.
4. Polyvinylchloride Pipe:
 - a. Solid Wall P.V.C. – SDR 35 with elastomeric gasket joints.
 - b. P.V.C. plastic pipe for storm sewer mains shall be manufactured in accordance with ASTM D2729-11.
- B. Pre-Cast Concrete Catch Basin:
 1. If catch basin grate is located in walking surfaces, grates to have maximum 1/2" openings perpendicular to path of travel per CBC 1133B.7.2. If grates have elongated openings, the grate shall be placed so the long dimension is perpendicular to the dominant direction of travel.
 2. Pre-cast concrete catch basin as manufactured by Brooks Products, Inc., San Diego Precast, or equal. Provide types and sizes as indicated on drawings, with traffic rated gate and frame, or equal. Grate and frame must be designed for HS20 loading.
 3. All catch basins must have a cast in place concrete bottom, formed to line and grade of the incoming and outgoing pipes. Absolutely no "wye" connections.
- C. Pre-Cast Concrete Manhole: 48 inch diameter pre-cast concrete manhole with eccentric entrance cone and grade rings as specified in the Standard Specifications of the **local Water District**. Larger manholes may be required as indicated on the plans. All manholes shall have cast in place concrete bottoms, formed to line and grade of incoming and outgoing pipes. All manholes shall be sealed in accordance with ASTM 2414.
- D. Concrete:
 1. Concrete for catch basins, culverts, and other drainage structures shall be 3000 psi concrete at 28 days and conform to the concrete specification 03 30 00.
 2. Prefabricated Drainage Structures: In accordance with Drawings.
- E. Full Capture Drain Inserts – Install full capture drain inserts in all catch basins. Use Triton, by CONTECH Construction Products, Inc. or equal.

PART 3 - EXECUTION

3.01 TRENCHING

- A. Excavate trenches per requirements stated in paragraph 1.03, Protection. Accurately shape and thoroughly compact trench bottom to grade. Excavate joint space when bells are used, so that the lowest 1/3 of pipe has firm bearing for its entire length. Lay pipe to lines and grades indicated with sections close jointed to form a smooth flow line. Keep trenches clean until installed work has been approved.

- B. Compaction shall be performed and comply with the related requirements of Section 31 23 00 – Excavation and Fill.

3.02 LAYING PIPE AND JOINTS

- A. The installation of pipe for the storm sewerage system shall be as specified in Section 306, latest edition of the Standard Specifications for Public Works Construction, and as shown on the Plans.
- B. Lay pipe to lines and grades indicated with sections close jointed to form a smooth flow line. All connections to mainlines shall be made at a 45 degree angle, or greater.
- C. Bedding material shall be clean sand as defined by Standard Specifications for Public Works Construction, current Edition (Green Book) Section 200-1.5, extending from 4-inches thick beneath the pipe to 12 inches above top of pipe. Place sand simultaneously on each side of the pipe, and thoroughly compact to provide lateral support for the line. Place remaining backfill in 6-inch layers above top of bedding material, moisten as required and compact with hand or pneumatic tampers. Compacting by flooding is prohibited.
- D. Lay bell, hub or groove ends up-grade; accurately center the following spigots in them.
- E. Reinforced Concrete Pipe: Lay pipe in accordance with APWA standards. Laser profile all RCP. Laser profiling should be conducted in accordance with NASSCO's Specification Guidelines SG-1.
- F. Polyvinylchloride Pipe: Lay and bed in accordance with ASTM D2321.
- G. Cast Iron Pipe: MG cast iron couplings with stainless steel bolts.
- H. HDPE pipe: Lay and bed in accordance with Green Book specifications, and these specifications.
- I. Unless otherwise indicated, lateral connections to main lines and angles in lines shall be made with the use of 45 degree wyes. 90 degree intersections are prohibited.
- J. Provide temporary caps, etc., during progress of work to prevent dirt or other debris from blocking lines.
- K. Provide running water test of system observed by an Inspector.

3.03 DRAINAGE STRUCTURES

- A. Construct reinforced concrete outlet boxes shall be constructed in accordance with Section 03 30 00 of these specifications at the dimensions and at the places shown on the Drawings.
- B. Manhole frame and cover, opening frame and anchors, ladder rings shall be as specified in the latest edition of the Standard Specifications for Public Works Construction.
- C. Construct to design and elevations indicated. Exposed concrete work shall have a smooth troweled finish with rounded corners and edges finished plumb and true. Provide grates, frames and covers for catch basins as detailed and indicated.

- D. Forms for concrete drainage structures shall be rigid and substantial. Plywood or tongue and grooved lumber shall be used for forming the exposed faces of concrete drainage structures. The top surfaces of the concrete shall be finished by bringing mortar to the surface by tamping, troweling smooth, and tooling the edges.
- E. Forms shall be kept in place not less than five days after placing unless otherwise directed or approved. Concrete work shall be cured by keeping it continuously wet for not less than seven days after placing.

3.04 INSTALLATION OF PIPE CLEAN-OUTS

- A. Install clean-outs at the places and at the sizes shown on the Plans.
- B. Clean-outs shall be installed in accordance with standards of the local Water District.

3.05 INSTALLATION OF BOX-TYPE CATCH BASINS

- A. Boxes shall be installed true to line and grade. Pipe shall be installed in the knock-out holes and grouted in place.
- B. The pipe shall be neatly trimmed to a flush surface with the inside wall of the box and the grout shall be finished flush with the inside wall of the box.
- C. A 12 inch wide by 4 inch thick Portland Cement concrete collar shall be placed around each of the inlet and outlet boxes. The collars shall be placed with the finished surface flush with the top of the boxes. Each collar shall receive a broom finish.

3.06 CONSTRUCTION OF OUTLET BOX

- A. Construct reinforced concrete outlet box where indicated on the Drawings.
- B. Install galvanized frames and grates where specified on the Drawings.

3.07 CLEAN-UP

- A. Upon completion of the work, storm drain systems shall be left free from silt, debris and obstructions.

END OF SECTION

SECTION 33 44 19

UTILITY STORM WATER TREATMENT

PART 1 – GENERAL

1.01 SUMMARY

- A. This section outlines actions required reduce water quality impacts from all construction activities and to achieve and maintain compliance with the California General NPDES Permit for Discharges Associated with Construction Activities where applicable. The work includes preparation and maintenance of a Storm Water Pollution Prevention Plan (SWPPP) or Water Pollution Control Plan (WPCP) and implementation and maintenance of storm water pollution prevention Best Management Practices (BMPs) required to control discharges to the storm water conveyance system. These requirements shall apply to all construction related areas and activities associated with the project, such as staging areas, equipment and material storage sites, waste management areas, and borrow pit operations which may be outside the construction limits.
- B. Related Documents
 - 1. Section 31 10 00 – Site Clearing.
 - 2. Section 31 20 00 – Earth Moving.
 - 3. Section 33 41 00: Storm Drainage

1.02 REFERENCES

- A. State Water Resources Control Board (SWRCB) Order No. 2009-0009-DWQ, National Pollutant Discharge Elimination System (NPDES), General Permit No. CAS000002, Waste Discharge Requirements (WDRs) for Discharges of Storm Water Runoff Associated with Construction Activity (General Construction Storm Water Permit) as amended, and/or modified
http://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/constpermits/wqo2009_0009_dwq.pdf.
- B. City of San Diego Storm Water Ordinance (San Diego Municipal Code §43.03, *Storm Water Management and Discharge Control*). This ordinance prohibits non-storm water discharges into the City's storm water conveyance system, including disposal of construction-related pollutants or sediments into the street gutter or storm drain (<http://clerkdoc.sannet.gov/Website/mc/mc.html>).
- C. California Storm Water Best Management Practices Handbook - Construction, January 2003, published by the California Stormwater Quality Association (www.cabmphandbooks.com).
- D. Caltrans Construction Site Best Management Practices Handbook, March 2003 (www.dot.ca.gov/hq/oppd/stormwtr/).
- E. Grossmont Union High School District M4 Permit .

1.03 SUBMITTALS

- A. For projects with total disturbed soil area \geq one acre:
1. Prior to the start of construction, the Contractor shall submit a SWPPP meeting the requirements of the current General Construction Storm Water Permit for all applicable phases of construction, including but not limited to: clearing, grading, excavating, filling, construction, paving, finish work and landscaping.
 2. Based on the complexity of the project, the District may elect to have the District's architect or design engineer prepare the SWPPP prior to the Contractor bid process. In this event the SWPPP shall be included in the bid specification for the Contractor. The Contractor may elect to make modifications to the SWPPP prior to construction. If the Contractor elects to modify the SWPPP, the modifications shall be submitted for review and approval by the District thirty days prior to construction. Modifications shall be subject to the review and approval of the District Project Manager or Construction Manager.
 3. SWPPPs shall be prepared by Contractor personnel or a subcontractor familiar with pollutant identification and storm water BMPs. If the District elects to have the SWPPP prepared prior to the bid process, the District's architect or design engineer may select an independent qualified engineer or qualified subcontractor to prepare the SWPPP. At a minimum, the preparer shall have completed at least 8 hours of training in construction storm water BMPs at courses offered by the Association of General Contractors, the Engineering General Contractors Association, local regulatory agencies, the International Erosion Control Association or other organizations acceptable to the District. Alternatively, the preparer shall be registered as a Certified Professional in Erosion and Sediment Control (CPESC) or a Professional Civil Engineer.
 4. The SWPPP shall include, but not be limited to, site information, identification of potential pollutants, and identification of appropriate storm water pollution prevention BMPs to be utilized by the Contractor throughout the duration of the project, designed to prevent unauthorized discharges. The SWPPP shall also include provisions for BMP maintenance, inspection, and repair and employee training. SWPPP BMPs shall include erosion and sediment controls, non-storm water management controls, materials and waste management controls, and post-construction storm water management controls. The SWPPP shall also include site plans with details of appropriate BMPs to be implemented and their locations for each phase of work. As with the SWPPP itself, these site plans must be updated as necessary when changes occur.
 5. The SWPPP shall include Sampling and Analysis Plans (SAPs) for non-visible pollutants and sediment (for any sites which discharge directly to water bodies that are 303(d)-listed as water quality impaired for sediment, siltation or turbidity – see the website referenced in Section 31 10 00, Item 1.02, A for more information).
 6. The Contractor is responsible for preparing the Notice of Intent, Annual Compliance Certification and Notice of Termination for signature by the District and District submittal to the SWRCB.
 7. The Contractor shall provide a complete copy of the SWPPP including all amendments and monitoring data (inspection reports and laboratory analysis reports) to the District upon completion of the project.

- B. For projects with total disturbed soil area < one acre or no disturbed soil area:
 - 1. Submit the name, title, work phone number and emergency phone number for the Contractor's designated person responsible for storm water pollution prevention. This person must be at the site throughout the project and will be responsible for ensuring compliance with requirements of this section. This person is also responsible for notifying the District of any non-compliance.
 - 2. Submit a WPCP that identifies potential construction-related pollutants and BMPs that will be used to prevent pollutants from discharging to the storm drain system. The WPCP shall include a site map identifying the direction of runoff flow, storm drain inlets or other off-site runoff discharge locations, areas of work, staging areas, construction site access points, and location where BMPs will be applied.
- C. SWPPP and WPCP Approval - The Contractor shall submit the SWPPP or WPCP at least thirty days prior to the scheduled start of construction to allow time for District review and approval. Work shall not be started until the SWPPP has been acknowledged by the Chief Operating Officer of the District and accepted by the District Project Manager or Construction Manager. Subsequent modifications and amendments to the SWPPP and WPCP are subject to the review and approval of the District Project Manager or Construction Manager.
 - 1. If the District's architect or design engineer prepares the SWPPP, the SWPPP shall be submitted at least thirty days prior to the scheduled Contractor bid process to allow time for District review and approval. The SWPPP shall be approved by the Chief Operating Officer of the District and accepted by the District Project Manager or Construction Manager.
- D. Other Submittal procedures and quantities are specified in Section 01 33 00.

1.03 RESPONSIBILITIES OF THE DISTRICT

- A. The District shall be responsible for signing and submitting the Notice of Intent, Annual Compliance Certification and Notice of Termination to the SWRCB along with submittal of standard annual permit fees.
- B. The District shall be responsible for maintaining a copy of the NOI, SWPPP (provided by the Contractor upon completion of the project), and NOT and other associated documents in accordance with "Retention of Records" provisions of the General Permit.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Products shall be as shown in the SWPPP or WPCP and specified in the publications listed in Section 31 10 00, Item 1.02.
- B. The Contractor shall have adequate materials on site to quickly deploy BMPs to protect the exposed portions of the site and to prevent sediment and pollutant discharges from the site.

- C. Erosion control BMPs may include but are not limited to: scheduling, slope roughening, preservation of existing vegetation, hydraulic mulches, temporary seeding, soil stabilizers and binders, bonded fiber matrix (BFM), erosion control blankets, and plastic covers. Temporary sediment control BMPs may include but are not limited to linear sediment barriers (e.g., silt fence, fiber rolls, gravel bag berms), sediment traps, storm drain inlet protection, tracking controls, and dust control. Non-storm water management BMPs may include but are not limited to: pavement cutting, vehicle and equipment cleaning, vehicle and equipment fueling and maintenance. Materials and Waste Management BMPs may include but are not limited to: material storage, stockpiles, spill prevention and control, clean up, and concrete waste management.

PART 3 – EXECUTION

3.01 GENERAL

- A. Comply with all provisions of the State Water Resources Control Board, National Pollutant Discharge Elimination System (NPDES), General Permit No. CAS000002, including requirements to collecting and analyzing storm water samples for non-visible pollutants and sediment/siltation, as described in the permit and as applicable to the project.
- B. Comply with all provisions of the City of San Diego Storm Water Ordinance (San Diego Municipal Code §43.03, *Storm Water Management and Discharge Control*).
- C. Allowable Non-Storm Water Discharges: In accordance with the City of San Diego Storm Water Ordinance, the following non-storm water discharges to the storm drain system (including canyons and creeks) are allowable upon the condition that the discharges do not cause or contribute to the violation of any Plan Water Quality objective and are not a significant source of pollutants:
1. Water line flushing and other discharges from potable or raw water supply sources.
 2. Landscape irrigation and lawn watering.
 3. Rising ground waters or springs.
 4. Uncontaminated pumped groundwater not subject to any applicable NPDES permit.
 5. Passive foundation and footing drains.
 6. Water from crawl space pumps.
 7. Air conditioning condensation.
 8. Non-commercial and residential washing of vehicles.
 9. Flows from riparian habitats and wetlands.
 10. Dechlorinated swimming pool discharges.
 11. Flows from fire fighting.

To assure that allowable non-stormwater discharges do not become a significant source of pollutants, the SWPPP or WPCP must identify the BMPs that will be implemented to control the discharge. The purpose of such BMPs is to prevent the allowable non-stormwater discharges from picking up and conveying pollutants from sources that may be in the discharge flowpath. Additionally, wherever feasible, alternatives that would not result in discharge of allowable non-stormwater discharges should be implemented.

- D. Prohibited Non-Storm Water Discharges: All other discharges to the storm drain system are prohibited including but not limited to: process and wash waters, dust, petroleum products, soil or sediment, litter or debris, paint or other construction-related wastes or materials. The Contractor shall be responsible for clean-up, mitigation, and penalties resulting from failure to implement and maintain appropriate BMPs for pollution prevention.

3.02 IMPLEMENTATION OF STORM WATER BMPs

- A. The Contractor shall implement appropriate BMPs to prevent and/or control potential discharges and to protect the storm water conveyance system from any and all activities with the potential to release materials directly or indirectly into the storm water conveyance system.
- B. Details and working drawings for BMPs are provided in the references listed in Section 03 10 00, Item 1.02. The Contractor shall provide an effective combination of Erosion and Sediment control BMPs, Non-Storm Water Management BMPs, and Materials and Waste Management BMPs.
- C. For projects with total disturbed soil area \geq one acre:
 - 1. Implement approved SWPPP as submitted per Section 31 10 00, Item 1.03, A.
- D. For projects with total disturbed soil area $<$ one acre:
 - 1. Implement approved WPCP as submitted per Section 31 10 00, Item 1.03, B.

3.03 TRAINING

- A. Contractor shall ensure that training on this special condition is given to all employees and subcontractors involved in construction activities. This training shall include but not be limited to the location of the storm drains on the job site; the direct link between the storm drain system and the bay; potential pollutants; and BMP installation, inspection, maintenance and repair.

3.04 NOTIFICATION

- A. The Contractor shall notify the Project Inspector/Construction Manager immediately of any unauthorized releases to the storm drain. The Contractor shall immediately document all unauthorized releases including but not limited to the time, date and duration, material released, and action taken to stop discharge and prevent future discharges. Documentation shall be provided to the Engineer and included in the SWPPP.

3.05 MAINTENANCE, INSPECTION, AND REPAIR OF BMPs

- A. The Contractor shall inspect BMPs before predicted rain events, and after rainfall. For prolonged events, greater than 24 hours, the Contractor shall inspect BMPs during the rain storm.
- B. The Contractor shall inspect BMPs in accordance with procedures identified in the references identified in Section 31 10 00, Item 1.02.
- C. The Contractor shall closely examine each BMP for 1) structural integrity; 2) sediment accumulation greater than 1/3 total depth; 3) evidence of excessive sediment downstream of BMPs or the site; and 4) evidence of other construction materials washed off-site.
- D. If a selected BMP fails or requires maintenance, it shall be maintained, repaired, modified, or replaced with an acceptable alternate as soon as it is safe to do so.

3.06 AUTHORITY OF THE ENGINEER

- A. The Engineer of Record/Architect of Record or Storm Water Manager has the authority to limit the surface area of soils exposed by clearing and grubbing, excavation, borrow and fill operations, and to direct the Contractor to provide immediate permanent or temporary BMPs to minimize pollutant transport. The Engineer has the authority to require BMPs to be installed or maintained by the Contractor at any time and to stop or delay work that could result in pollutant transport, until such time as the Contractor provides adequate BMP protection.

PART 4 - MEASUREMENT AND PAYMENT

4.01 Storm Water Pollution Prevention will be paid for at the Contract lump sum amounts for the below items:

- A. Preparation of the SWPPP
- B. Construction BMPs
- C. Inspection of Construction BMPs
- D. Maintenance of Construction BMPs
- E. Collection and Analysis of Storm Water Samples

These amounts shall include full compensation for furnishing all labor, materials, equipment, tools, and incidentals and for doing all the work of these items, complete in place, including cleanup, as specified in these Specifications.

END OF SECTION

SECTION 33 46 13

FOUNDATION DRAINAGE

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes: Prefabricated drainage membrane systems for below-grade vertical applications, as indicated on the Drawings and specified herein.
- B. Related Sections:
 - 1. Section 04 22 00 – Concrete Unit Masonry.

1.02 WARRANTY

- A. Provide two year unconditional guarantee against defects of materials and workmanship which allows water or moisture into areas of the structure which were to be protected by this membrane. Pay for costs of repairing or replacing the defective membrane, as well as costs of exposing and recovering membrane, and consequential damages to persons and property resultant of defective materials or workmanship.

PART 2 - PRODUCTS

2.01 FOUNDATION DRAINAGE SYSTEM: Foundation drainage systems are to be a molded sheet drainage panel system.

- A. Acceptable Manufacturers:
 - 1. Amerdrain 500 by American Wick Drain Corp.
 - 2. Hydroduct by W.R. Grace & Co.
- B. Use a prefabricated, composite drainage system made with drainage core and filter fabric with a minimum flow rate of 15 gpm/foot at 1 hydraulic gradient and 3,600 psf normal pressure.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install systems using waterproofing installers. Roofing trades will not be acceptable to perform this work.
- B. Install systems in strict accordance with manufacturer's specifications. Obtain manufacturer's approval of substrate conditions prior to installing materials.
- C. Provide reinforcing strips, and backer rods necessary for joints and cracks.

END OF SECTION