

PROJECT MANUAL

Murrieta Elementary School New CR Bldg

24725 Adams Ave.

Murrieta, CA, 92562

Prepared For:

Murrieta Valley Unified School District

41870 McAlby Court

Murrieta, CA

BNds Project Number 18009-00

SIGNATURES

PROJECT

Murrieta Elementary School New Classroom Building
BNds Project No. 18009-00

OWNER

Murrieta Valley Unified School District
Murrieta, CA

ARCHITECT

BakerNowick Design Studio
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(619) 795-2450
Richard Nowicki, Partner C-28042



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KNA STRUCTURAL ENGINEERS

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CIVIL ENGINEER:
EPIC ENGINEERS

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GROUNDLEVEL LANDSCAPE ARCHITECTURE

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FIRE PROTECTION:
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DSA APPROVAL

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT

APP: 04-119432 INC:

REVIEWED FOR

SS ☒

FLS ☒

ACS ☒

DATE: 12/24/2020

SECTION 000110

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SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Project information.
 - 2. Work covered by Contract Documents.
 - 3. Phased construction.
 - 4. Work performed by Owner.
 - 5. Multiple Work Packages.
 - 6. Work under Owner's separate contracts.
 - 7. Future work not part of this Project.
 - 8. Owner's product purchase contracts.
 - 9. Owner-furnished/Contractor-installed (OFICI) products.
 - 10. Contractor's use of site and premises.
 - 11. Coordination with occupants.
 - 12. Work restrictions.
 - 13. Specification and Drawing conventions.
 - 14. Miscellaneous provisions.
- B. Related Requirements:
 - 1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.
 - 2. Section 017300 "Execution" for coordination of Owner-installed products.

1.3 DEFINITIONS

- A. Work Package: A group of specifications, drawings, and schedules prepared by the design team to describe a portion of the Project Work for pricing, permitting, and construction.

1.4 PROJECT INFORMATION

- A. Project Identification: Murrieta Elementary School New Classroom Building
 - 1. Project Location: 24725 Adams Ave, Murrieta, CA 92562
- B. Owner: Murrieta Valley Unified School District.
 - 1. Owner's Representative: Lori Noorigian, Director of Facilities.
- C. Architect: BakerNowicki Design Studio
 - 1. Architect's Representative: Richard Nowicki, Architect.
- D. Architect's Consultants: Architect has retained the following design professionals, who have prepared designated portions of the Contract Documents:
 - 1. Project Directory:
 - a. Civil: Epic Engineers; 101 E. Redlands Blvd. Suite 146 Redlands, CA 92373 (909) 792-5969
 - b. Landscape: Groundlevel2605 State Street, San Diego, CA 92103 (619) 325-1990.

- c. Structural: KNA Consulting Engineers; 9931 Muirlands Blvd. Irvine, CA 92618 (949) 462-3200
 - d. Mechanical Engineer: Dufoe Engineers; 9665 Chesapeake Drive, Suite 320 San Diego, CA 92123 (951) 240-3340
 - e. Electrical Engineer: Johnson Consulting Engineers, 12875 Brookprinter Place, Suite 300 Poway, CA 92064 (858) 679-4030
 - f. Fire Protection: Protection Design & Consulting; 2851 Camino Del Rio South, #400 San Diego, CA 92108 (619) 255-9363
 - E. Web-Based Project Software: Project software will be used for purposes of managing communication and documents during the construction stage.
 - 1. See Section 013100 "Project Management and Coordination." for requirements for using web-based Project software.
- 1.5 WORK COVERED BY CONTRACT DOCUMENTS
- A. The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:
 - 1. New 2 story Classroom Building on the existing campus of Murrieta Elementary School, with 13 classrooms, offices, Restrooms and storage.
 - 2. Sitework including, Parking Lot, Hardcourts, Courtyard, Entry Plaza and other Work indicated in the Contract Documents.
- 1.6 WORK PERFORMED BY OWNER
- A. Cooperate fully with Owner, so work may be carried out smoothly, without interfering with or delaying Work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.
- 1.7 OWNER-FURNISHED/CONTRACTOR-INSTALLED (OFCI) PRODUCTS
- A. Owner's Responsibilities: Owner will furnish products indicated and perform the following, as applicable:
 - 1. Provide to Contractor Owner-reviewed Product Data, Shop Drawings, and Samples.
 - 2. Provide for delivery of Owner-furnished products to Project site.
 - 3. Upon delivery, inspect, with Contractor present, delivered items.
 - a. If Owner-furnished products are damaged, defective, or missing, arrange for replacement.
 - 4. Obtain manufacturer's inspections, service, and warranties.
 - 5. Inform Contractor of earliest available delivery date for Owner-furnished products.
 - B. Contractor's Responsibilities: The Work includes the following, as applicable:
 - 1. Designate delivery dates of Owner-furnished products in Contractor's construction schedule, utilizing Owner-furnished earliest available delivery dates.
 - 2. Review Owner-reviewed Product Data, Shop Drawings, and Samples, noting discrepancies and other issues in providing for Owner-furnished products in the Work.
 - 3. Receive, unload, handle, store, protect, and install Owner-furnished products.
 - 4. Make building services connections for Owner-furnished products.
 - 5. Protect Owner-furnished products from damage during storage, handling, and installation and prior to Substantial Completion.
 - 6. Repair or replace Owner-furnished products damaged following receipt.
 - C. Owner-Furnished/Contractor-Installed (OFCI) Products:

1. Bell to install at top of Elevator Tower

1.8 CONTRACTOR'S USE OF SITE AND PREMISES

- A. Restricted Use of Site: Each Contractor 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. Limits on Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 1. Driveways, Walkways and Entrances: Keep driveways parking garage, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.
- D. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.9 COORDINATION WITH OCCUPANTS

- A. Full Owner Occupancy: Owner will occupy Project site and adjacent building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.
 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
 2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.
- B. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.
 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
 2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.
- C. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with

completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.

1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.10 WORK RESTRICTIONS

- A. Comply with restrictions on construction operations.
 1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work to between 7:00 a.m. to 5:00 p.m., Monday through Friday, unless otherwise indicated. Work hours may be modified to meet Project requirements if approved by Owner and authorities having jurisdiction.
 1. Weekend and Evening Hours: Requires owner's permission .
- C. On-Site Work Day Restrictions: Do not perform work resulting in utility shutdowns on-site during work black-out days indicated in Document 003113 "Preliminary Schedules."
- D. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging for temporary utility services according to requirements indicated:
 1. Notify Construction Manager and Owner] not less than two days in advance of proposed utility interruptions.
 2. Obtain Construction Manager's and Owner's written permission before proceeding with utility interruptions.
- E. Noise, Vibration, Dust, and Odors: Coordinate operations that may result in high levels of noise and vibration, dust, odors, or other disruption to Owner occupancy with Owner.
 1. Notify Construction Manager and Owner not less than [two days in advance of proposed disruptive operations.
 2. Obtain Construction Manager's and Owner's] written permission before proceeding with disruptive operations.
- F. Smoking and Controlled Substance Restrictions: Use of tobacco products , alcoholic beverages, and other controlled substances on Owner's property is not permitted.
- G. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.
- H. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.
 1. Maintain list of approved screened personnel with Owner's representative.

1.11 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. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
 3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
 4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.
- C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- D. 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 published as part of the U.S. National CAD Standard.
 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 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.

1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.
- B. Contractors proposing to use an "equal" product, when listed as acceptable in the products sections of this specifications by the term "or equal," are proposing a substitution and must conform to all requirements of substitutions as listed in this section.

1.4 AGENCY REQUIREMENTS

- A. All substitutions affecting ACS, FLS and SS shall be considered a change order or addenda and shall be approved by DSA prior to fabrication and installation. (Section 4-338, Part 1).

1.5 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 provided in Project Manual.
 - 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.
 - j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating 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. Contractor'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. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Contractor agrees to compensate Architect, at Architects current billing rates, for substitution requests that require modification to the Contract Documents. Compensation shall be made by an adjustment to the Contract amount.
 - a. Where required by Division of the State Architect (D.S.A.) approvals, the Contractor shall pay all plan check fees. Or fees required to obtain approval.
 - b. The Contractor shall pay the Architect and his Consultants for all services rendered for the drawings, calculations, review time, and/or D.S.A. plan check time for each substitute item(s) for approval.
 4. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within a reasonable period after the Architect receives final documentation.
 - 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.

1.6 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.

1.7 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

- A. Substitutions for Cause: Substitutions may be considered when a Product becomes unavailable through no fault of the Contractor. Submit requests for substitution immediately on discovery of need for change, but not later than 30 days prior to time required for preparation and review of related submittals.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Substitution request is fully documented and properly submitted.
 - c. Requested substitution will not adversely affect Contractor's construction schedule.
 - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - e. Requested substitution is compatible with other portions of the Work.
 - f. Requested substitution has been coordinated with other portions of the Work.
 - g. Requested substitution provides specified warranty.
 - h. 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.
 - i. A maximum of one substitution request shall be submitted for any one item\
- B. Substitutions for Convenience: **Requests are restricted to before bid opening.**
- C. The Instruction to bidders specify time restrictions for submitting request for Substitution during the bidding periods according to the requirements specified in this section. In the event that the bidder does not agree in the request form to provide the specified item and the District denies the request substitution, the bidder's bid shall be considered non-responsive and the District may award the contract to the next lowest bidder or in its sole discretion, release all bidders.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Requirements:
 - 1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.
 - 2. Section 013100 "Project Management and Coordination" for requirements for forms for contract modifications provided as part of web-based Project management software.

1.3 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 AIA Document G710.

1.4 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 Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - e. Quotation Form: Use forms acceptable to Architect.
- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor 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 Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
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. Proposal Request Form: Use form acceptable to Architect.

1.5 ADMINISTRATIVE CHANGE ORDERS

- A. Allowance Adjustment: See Section 012100 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.
- B. Unit-Price Adjustment: See Section 012200 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.6 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Change Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on form included in Project Manual.

1.7 CONSTRUCTION CHANGE DIRECTIVE

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

1.8 WORK CHANGE DIRECTIVE

- A. Work Change Directive: Architect may issue a Work Change Directive on **form included in Project Manual**. Work Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 1. Work 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 Work Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
 - 1. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
 - 2. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.3 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
 - 1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
 - 2. Submit the schedule of values to Architect through Construction Manager 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. Owner's name.
 - c. Owner's Project number.
 - d. Name of Architect.
 - e. Architect's Project number.
 - f. Contractor's name and address.
 - g. Date of submittal.
 - 2. Arrange schedule of values consistent with format of AIA Document G703
 - 3. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.

- f. Change Orders (numbers) that affect value.
 - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment.
- 4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of 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.
 - a. Differentiate between items stored on-site and items stored off-site.
- 6. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
- 7. Purchase Contracts: Provide a separate line item in the schedule of values for each Purchase contract. Show line-item value of Purchase contract. Indicate Owner payments or deposits, if any, and balance to be paid by Contractor.
- 8. Overhead Costs, Proportional Distribution: Include total cost and proportionate share of general overhead and profit for each line item.
- 9. Overhead Costs, Separate Line Items: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
- 10. Temporary Facilities: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
- 11. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments, as certified by Architect and Construction Manager and paid for by Owner.
- B. Payment Application Times: The date for each progress payment is indicated in the Owner/Contractor Agreement. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
 - 1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.
- C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Construction Manager will return incomplete applications without action.
 - 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.

2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
 4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
- E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 3. Provide summary documentation for stored materials indicating the following:
 - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
 - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Construction Manager 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.
- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
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. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.
- H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of values.
 3. Contractor's construction schedule (preliminary if not final).
 4. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.

5. Sustainable design action plans, including preliminary project materials cost data.
 6. Schedule of unit prices.
 7. Submittal schedule (preliminary if not final).
 8. List of Contractor's staff assignments.
 9. Copies of building permits.
 10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 11. Initial progress report.
 12. Report of preconstruction conference.
 13. Certificates of insurance and insurance policies.
 14. Performance and payment bonds.
- I. 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 Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- J. 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. Certification of completion of final punch list items.
 3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 4. Updated final statement, accounting for final changes to the Contract Sum.
 5. AIA Document G706.
 6. AIA Document G706A.
 7. AIA Document G707.
 8. Evidence that claims have been settled.
 9. 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.
 10. Final liquidated damages settlement statement.
 11. Proof that taxes, fees, and similar obligations are paid.
 12. Waivers and releases.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Coordination drawings.
 - 3. RFIs.
 - 4. Digital project management procedures.
 - 5. Project meetings.
- B. Related Requirements:
 - 1. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.3 DEFINITIONS

- A. BIM: Building Information Modeling.
- B. RFI: Request for Information. Request from Owner, Construction Manager, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 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, telephone number, and email address 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.

1.5 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. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and scheduled activities of other contractors to

avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

C. Construction Documents Gaps, Conflicts, and Cost

1. When conflicts in construction documents are identified, the contractor shall, at the time of bidding, assume the most costly solution as presented in the construction documents unless otherwise clarified by a Request for Information. A credit will be provided to the owner if the less costly design/option is selected. Contractor to provide notification to the design team when such circumstances are identified.
2. All Items shown in the construction drawings or specifications should be assumed by the contractor to have all necessary connections, even when not indicated on the construction drawings. Drinking fountains, roof drains, pumps, outlets, etc, should be assumed to be furnished with all necessary plumbing, electrical, data, mechanical, or structural connections for the equipment or item to function. Contractor to assume the scope of all such items in their initial bids.
3. Where Contractor, as a component of BIM coordination, re-routes assemblies or building systems due to conflict coordination procedures, changes for these revisions will not be considered a change in cost, scope or schedule as they are identified in advance of installation.

1.6 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

B.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
2.
 - a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - b. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

C. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of

- visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
 3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
 4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
 5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
 6. Review: Architect will review coordination drawings to confirm that in general the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility.
 7. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
 8. File Submittal Format: Submit or post coordination drawing files using format same as file preparation format.
 9. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
 - a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
 - b. Digital Data Software Program: Drawings are available in Revit 2019 and ACAD2019 >.
 - c. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.

1.7 REQUEST FOR INFORMATION (RFI)

- A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
 1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor'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 Contractor.
 5. Name of Architect and Construction Manager.
 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. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 12. Contractor'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 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 Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.
 - f. Requests for interpretation of Architect's actions on submittals.
 - g. 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 by Architect of additional information.
- 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 Contractor.
 3. Name and address of Architect and Construction Manager.
 4. RFI number including RFIs that were returned without action or withdrawn.
 5. RFI description.
 6. Date the RFI was submitted.
 7. Date Architect's and Construction Manager's response was received.
- F. On receipt of Architect's and Construction Manager's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect and Construction Manager within seven days if Contractor disagrees with response.
- 1.8 DIGITAL PROJECT MANAGEMENT PROCEDURES
- A. Architect's Data Files Not Available: Architect will not provide Architect's BIM model CAD drawing digital data files for Contractor's use during construction.
- B. Use of Architect's Digital Data Files: Digital data files of Architect's BIM model CAD drawings will be provided by Architect for Contractor's use during construction.
- C. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project record Drawings.
1. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.

2. Digital Drawing Software Program: Contract Drawings are available in Revit 2019 and ACAD 2019
 3. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.
 - a.]
- D. D.Web-Based Project Software: Use Owner's web-based Project software site for purposes of hosting and managing Project communication and documentation until Final Completion.
1. 1. Web-based Project software site includes, at a minimum, the following features:
 - a. a. Compilation of Project data, including Contractor, subcontractors, Architect, architect's consultants, Owner, and other entities involved in Project. Include names of individuals and contact information.
 - b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
 - c. Document workflow planning, allowing customization of workflow between project entities.
 - d. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Minor Changes in the Work, Construction Change Directives, and Change Orders.
 - e. Track status of each Project communication in real time, and log time and date when responses are provided.
 - f. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
 - g. Processing and tracking of payment applications.
 - h. Processing and tracking of contract modifications.
 - i. Creating and distributing meeting minutes.
 - j. Document management for Drawings, Specifications, and coordination drawings, including revision control.
 - k. Management of construction progress photographs.
 - l. Mobile device compatibility, including smartphones and tablets.
 2. 2. Provide up to **seven** web-based Project software user licenses for use of Owner, Construction Manager, Architect, and Architect's consultants. Provide eight hours of software training at Architect's office for web-based Project software users.
 3. At completion of Project, provide digital archive in format that is readable by common desktop software applications in format acceptable to Architect. Provide data in locked format to prevent further changes.
 4. Provide one of the following web-based Project software packages under their current published licensing agreements:
 - a. Autodesk;.
 - b. Corecon Technologies, Inc.
 - c. Meridian Systems; Prolog.
 - d. Newforma, Inc.
 - e. Procore Technologies, Inc.
 - f. Viewpoint, Inc.; Viewpoint for Project Collaboration.
- E. E. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:
1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
 2. Name file with submittal number or other unique identifier, including revision identifier.

3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.9 PROJECT MEETINGS

- A. General: Construction Manager will schedule and conduct meetings and conferences at Project site unless otherwise indicated.
- B. Preconstruction Conference: Construction Manager will 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, Construction Manager, Architect, and their consultants; Contractor 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. Responsibilities and personnel assignments.
 - b. Tentative construction schedule.
 - c. Phasing.
 - d. Critical work sequencing and long lead items.
 - e. Designation of key personnel and their duties.
 - f. Lines of communications.
 - g. Use of web-based Project software.
 - h. Procedures for processing field decisions and Change Orders.
 - i. Procedures for RFIs.
 - j. Procedures for testing and inspecting.
 - k. Procedures for processing Applications for Payment.
 - l. Distribution of the Contract Documents.
 - m. Submittal procedures.
 - n. Sustainable design requirements.
 - o. Preparation of Record Documents.
 - p. Use of the premises.
 - q. Work restrictions.
 - r. Working hours.
 - s. Owner's occupancy requirements.
 - t. Responsibility for temporary facilities and controls.
 - u. Procedures for moisture and mold control.
 - v. Procedures for disruptions and shutdowns.
 - w. Construction waste management and recycling.
 - x. Parking availability.
 - y. Office, work, and storage areas.
 - z. Equipment deliveries and priorities.
 - aa. First aid.
 - bb. Security.
 - cc. Progress cleaning.
 - dd.
 3. Minutes: Contractor will record and distribute meeting minutes.
 - 4.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other sections and when required for 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, Construction Manager 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 requirements.
 - 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] [Construction Manager will conduct] progress meetings at [weekly] [biweekly] [monthly] [regular] <Insert appropriate interval> intervals.
1. Coordinate dates of meetings with preparation of payment requests.
 2. Attendees: In addition to representatives of Owner, Owner's Commissioning Authority 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.
 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

- a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Resolution of BIM component conflicts.
 - 4) Status of submittals.
 - 5) Status of sustainable design documentation.
 - 6) Deliveries.
 - 7) Off-site fabrication.
 - 8) Access.
 - 9) Site use.
 - 10) Temporary facilities and controls.
 - 11) Progress cleaning.
 - 12) Quality and work standards.
 - 13) Status of correction of deficient items.
 - 14) Field observations.
 - 15) Status of RFIs.
 - 16) Status of Proposal Requests.
 - 17) Pending changes.
 - 18) Status of Change Orders.
 - 19) Pending claims and disputes.
 - 20) Documentation of information for payment requests.
4. Minutes: Contractor will record and distribute the meeting minutes to each party present and to parties requiring information.
- a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Startup construction schedule.
 - 2. Contractor's Construction Schedule.
 - 3. Construction schedule updating reports.
 - 4. Daily construction reports.
 - 5. Material location reports.
 - 6. Site condition reports.
 - 7. Unusual event reports.
- B. Related Requirements:
 - 1. Section 014000 "Quality Requirements" for schedule of tests and inspections.
 - 2. Section 012900 "Payment Procedures" for schedule of values and requirements for use of cost-loaded schedule for Applications for Payment.

1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. Cost Loading: The allocation of the schedule of values for completing an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum.
- C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- D. Event: The starting or ending point of an activity.
- E. Resource Loading: The allocation of manpower and equipment necessary for completing an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. Working electronic copy of schedule file.
 - 2. PDF file.
 - 3. Two paper copies, of sufficient size to display entire period or schedule, as required.
- B. Startup construction schedule.

1. Submittal of cost-loaded startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.
- C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
 1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals.
- E. Construction Schedule Updating Reports: Submit with Applications for Payment.
- F. Daily Construction Reports: Submit at weekly intervals.
- G. Material Location Reports: Submit at **weekly** intervals.
- H. Site Condition Reports: Submit at time of discovery of differing conditions.
- I. Unusual Event Reports: Submit at time of unusual event.
- J. Qualification Data: For scheduling consultant.

1.5 QUALITY ASSURANCE

- A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Architect's request.
- B. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's Construction Schedule, including, but not limited to, the following:
 1. Review software limitations and content and format for reports.
 2. Verify availability of qualified personnel needed to develop and update schedule.
 3. Discuss constraints, including phasing.
 4. Review delivery dates for Owner-furnished products.
 5. Review schedule for work of Owner's separate contracts.
 6. Review submittal requirements and procedures.
 7. Review time required for review of submittals and resubmittals.
 8. Review requirements for tests and inspections by independent testing and inspecting agencies.
 9. Review time required for Project closeout and Owner startup procedures.
 10. Review and finalize list of construction activities to be included in schedule.
 11. Review procedures for updating schedule.

1.6 COORDINATION

- A. Coordinate Contractor's Construction Schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
 1. Secure time commitments for performing critical elements of the Work from entities involved.
 2. Coordinate each construction activity in the network with other activities, and schedule them in proper sequence.

1.7 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.
- B. Time Frame: Extend schedule from date established for commencement of the Work the Notice of Award the Notice to Proceed to date of Substantial Completion Final Completion.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
 - 1. Phasing: Arrange list of activities on schedule by phase.
 - 2. Work under More Than One Contract: Include a separate activity for each contract.
 - 3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
 - 4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 - 5. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 - 6. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before Substantial Completion.
 - e. Use-of-premises restrictions.
 - f. Provisions for future construction.
 - g. Seasonal variations.
 - h. Environmental control.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion
 - 1. Temporary enclosure and space conditioning.
 - 2.
- E. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
 - 1. See Section 012900 "Payment Procedures" for cost reporting and payment procedures.
- F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
 - 1. Unresolved issues.
 - 2. Unanswered Requests for Information.
 - 3. Rejected or unreturned submittals.
 - 4. Notations on returned submittals.
 - 5. Pending modifications affecting the Work and the Contract Time.
- G. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 3. As the Work progresses, indicate Final Completion percentage for each activity.
- H. Distribution: Distribute copies of approved schedule to Architect, Construction Manager, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.
- 1.8 GANTT-CHART SCHEDULE REQUIREMENTS
- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's Construction Schedule within 30 days of date established for the Notice to Proceed.
1. Base schedule on the startup construction schedule and additional information received since the start of Project.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in **10** percent increments within time bar.
- 1.9 REPORTS
- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
 2. List of separate contractors at Project site.
 3. Approximate count of personnel at Project site.
 4. Equipment at Project site.
 5. Material deliveries.
 6. High and low temperatures and general weather conditions, including presence of rain or snow.
 7. Testing and inspection.
 8. Accidents.
 9. Meetings and significant decisions.
 10. Unusual events.
 11. Stoppages, delays, shortages, and losses.
 12. Meter readings and similar recordings.
 13. Emergency procedures.
 14. Orders and requests of authorities having jurisdiction.
 15. Change Orders received and implemented.
 16. Construction Change Directives received and implemented.
 17. Services connected and disconnected.
 18. Equipment or system tests and startups.
 19. Partial completions and occupancies.

20. Substantial Completions authorized.

- B. Material Location Reports: At weekly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:
 - 1. Material stored prior to previous report and remaining in storage.
 - 2. Material stored prior to previous report and since removed from storage and installed.
 - 3. Material stored following previous report and remaining in storage.
- C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.
- D. Unusual Event Reports: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, responses by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.
 - 1. Submit unusual event reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013200

SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Preconstruction photographs.
 - 2. Concealed Work photographs.
 - 3. Periodic construction photographs.
 - 4. Final Completion construction photographs.
 - 5. Preconstruction video recordings.
 - 6. Periodic construction video recordings.
 - 7. Construction webcam.
- B. Related Requirements:
 - 1. Section 017700 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.
 - 2. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.
 - 3. Section 024116 "Structure Demolition" for photographic documentation before building demolition operations commence.
 - 4. Section 311000 "Site Clearing" for photographic documentation before site clearing operations commence.

1.3 INFORMATIONAL SUBMITTALS

- A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
- B. Digital Photographs: Submit image files within three days of taking photographs.
 - 1. Submit photos on CD-ROM or thumb-drive. Include copy of key plan indicating each photograph's location and direction.
 - 2. Identification: Provide the following information with each image description in file metadata tag:
 - a. Name of Project.
 - b. Name and contact information for photographer.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Date photograph was taken.
 - f. Description of location, vantage point, and direction.
 - g. Unique sequential identifier keyed to accompanying key plan.
- C. Printed Photographs: Submit two sets of prints of each photographic view within seven days of taking photographs.
 - 1. Format: 8-by-10-inch smooth-surface matte prints on single-weight, paper; enclosed back to back in clear plastic sleeves punched for three-ring binder. Include copy of key plan

indicating each photograph's location and direction. Provide one binder for each set of prints.

2. Identification: On back of each print, label with the following information:
 - a. Name of Project.
 - b. Name and contact information for photographer.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Date photograph was taken if not date stamped by camera.
 - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - g. Unique sequential identifier keyed to accompanying key plan.

D. Video Recordings: Submit video recordings within sevendays of recording.

1. Submit video recordings on CD-ROM or thumb drive. Include copy of key plan indicating each video's location and direction.
2. Identification: With each submittal, provide the following information in file metadata tag:
 - a. Name of Project.
 - b. Name and address of photographer.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Date video recording was recorded.
 - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
3. Transcript: Prepared on 8-1/2-by-11-inch paper, punched and bound in three-ring binders. Provide label on front and spine. Include a cover sheet with label information. Include name of Project and date of video recording on each page.

1.4 QUALITY ASSURANCE

- A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.
- B. Construction Webcam Service Provider: A firm specializing in providing photographic equipment, web-based software, and related services for construction projects, with a record of providing satisfactory services similar to those required for Project.

1.5 FORMATS AND MEDIA

- A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels. Use flash in low light levels or backlit conditions.
- B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full high-definition mode. Provide supplemental lighting in low light levels or backlit conditions.
- C. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
- D. Metadata: Record accurate date and time from camera.
- E. File Names: Name media files with date and sequential numbering suffix.

1.6 CONSTRUCTION PHOTOGRAPHS

- A. Photographer: Engage a qualified photographer to take construction photographs.
- B. General: Take photographs with maximum depth of field and in focus.
 - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- C. Preconstruction Photographs: Before commencement of the Work, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
 - 1. Flag construction limits before taking construction photographs.
 - 2. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
 - 3. Take 20 photographs of existing buildings either on or adjoining property, to accurately record physical conditions at start of construction.
 - 4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- D. Concealed Work Photographs: Before proceeding with installing work that will conceal other work, take photographs sufficient in number, with annotated descriptions, to record nature and location of concealed Work, including, but not limited to, the following:
 - 1. Underground utilities.
 - 2. Underslab services.
 - 3. Piping.
 - 4. Electrical conduit.
 - 5. Waterproofing and weather-resistant barriers.
- E. Periodic Construction Photographs: Take 20 photographs weekly. Select vantage points to show status of construction and progress since last photographs were taken.
- F. Final Completion Construction Photographs: Take 20 photographs after date of Substantial Completion for submission as Project Record Documents. Architect will inform photographer of desired vantage points.
- G. Additional Photographs: Architect may request photographs in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.
 - 1. Three days' notice will be given, where feasible.
 - 2. In emergency situations, take additional photographs within 24 hours of request.
 - 3. Circumstances that could require additional photographs include, but are not limited to, the following:
 - a. Special events planned at Project site.
 - b. Immediate follow-up when on-site events result in construction damage or losses.
 - c. Photographs shall be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
 - d. Substantial Completion of a major phase or component of the Work.
 - e. Extra record photographs at time of final acceptance.
 - f. Owner's request for special publicity photographs.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013233

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Submittal schedule requirements.
 - 2. Administrative and procedural requirements for submittals.
- B. Related Requirements:
 - 1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
 - 2. Section 013100 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
 - 3. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
 - 4. Section 014000 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
 - 5. Section 017700 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
 - 6. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
 - 7. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.4 SUBMITTAL SCHEDULE

- A. Submittal Schedule: Submit, as an action submittal, a list 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 Construction Manager and additional time for handling and reviewing submittals required by those corrections.
 - 1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
 - 2. Initial Submittal Schedule: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals

required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

3. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule as required to reflect changes in current status and timing for submittals.
4. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal Category: Action; informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for Architect's final release or approval.
 - g. Scheduled dates for purchasing.

1.5 SUBMITTAL FORMATS

- A. Submittal Information: Include the following information in each submittal:
 1. Project name.
 2. Date.
 3. Name of Architect.
 4. Name of Construction Manager.
 5. Name of Contractor.
 6. Name of firm or entity that prepared submittal.
 7. Names of subcontractor, manufacturer, and supplier.
 8. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier and alphanumeric suffix for resubmittals.
 9. Category and type of submittal.
 10. Submittal purpose and description.
 11. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
 12. Drawing number and detail references, as appropriate.
 13. Indication of full or partial submittal.
 14. Location(s) where product is to be installed, as appropriate.
 15. Other necessary identification.
 16. Remarks.
 17. Signature of transmitter.
- B. Options: Identify options requiring selection by Architect.
- C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.
- D. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.
- E. Submittals Utilizing Web-Based Project Software: Prepare submittals as PDF files or other format indicated by Project management software.

1.6 SUBMITTAL PROCEDURES

- A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 - 1. Email: Prepare submittals as PDF package and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.
 - a. Architect will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.
 - 2. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project management software website. Enter required data in web-based software site to fully identify submittal.
 - 3. Paper: Prepare submittals in paper form and deliver to Architect.
- 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.
 - 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 - 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
- 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 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 - 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 - 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
 - 4. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Construction Manager, through Architect, before being returned to Contractor.
 - a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect and Construction Manager.
- D. 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 and Construction Manager's action stamp.
- E. 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.

- F. 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 and Construction Manager's action stamp.

1.7 SUBMITTAL REQUIREMENTS

- A. 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 unsuitable 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 that show 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 Shop Drawings, and before or concurrently with Samples.
- B. 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.
- C. Samples: Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.
1. Transmit Samples that contain multiple, related components, such as accessories together in one submittal package.
 2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
 - a. Project name and submittal number.
 - b. Generic description of Sample.
 - c. Product name and name of manufacturer.
 - d. Sample source.
 - e. Number and title of applicable Specification Section.

- f. Specification paragraph number and generic name of each item.
 3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics and identification information for record.
 4. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
 5. Paper Transmittal: Include paper transmittal, including complete submittal information indicated.
 6. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
- D. Certificates:
1. Certificates and Certifications Submittals: Submit 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. Provide a notarized signature where indicated.
 2. 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.
 3. 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.
 4. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
 5. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
 6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel certified.
- E. Test and Research Reports:
1. 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 substrate preparation and primers required.
 2. 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.
 3. 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.
 4. 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.

5. 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.
6. 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. Include the following information:
 - a. Name of evaluation organization.
 - b. Date of evaluation.
 - c. Time period when report is in effect.
 - d. Product and manufacturers' names.
 - e. Description of product.
 - f. Test procedures and results.
 - g. Limitations of use.

1.8 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.
- C. BIM Incorporation: Incorporate delegated-design drawing and data files into BIM established for Project.
 1. Prepare delegated-design drawings in the following format: Same digital data software program, version, and operating system as original Drawings

1.9 CONTRACTOR'S REVIEW

- A. Action Submittals and Informational 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. Contractor's Approval: Indicate Contractor's approval for each submittal with indication in web-based Project management software. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
 1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.10 ARCHITECT'S REVIEW

- A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return.
 - 1. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action .
 - 2. Submittals by Web-Based Project Management Software: Architect will indicate, on Project management software website, the appropriate action.
 - a. Actions taken by indication on Project management software website have the following meanings:
- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect and Construction Manager will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013300

SECTION 013516 - ALTERATION PROJECT PROCEDURES

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 special procedures for alteration work.

1.3 DEFINITIONS

- A. Alteration Work: This term includes remodeling, renovation, repair, and maintenance work performed within existing spaces or on existing surfaces as part of the Project.
- B. Consolidate: To strengthen loose or deteriorated materials in place.
- C. Design Reference Sample: A sample that represents the Architect's prebid selection of work to be matched; it may be existing work or work specially produced for the Project.
- D. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.
- E. Match: To blend with adjacent construction and manifest no apparent difference in material type, species, cut, form, detail, color, grain, texture, or finish; as approved by Architect.
- F. Refinish: To remove existing finishes to base material and apply new finish to match original, or as otherwise indicated.
- G. Repair: To correct damage and defects, retaining existing materials, features, and finishes. This includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials.
- H. Replace: To remove, duplicate, and reinstall entire item with new material. The original item is the pattern for creating duplicates unless otherwise indicated.
- I. Replicate: To reproduce in exact detail, materials, and finish unless otherwise indicated.
- J. Reproduce: To fabricate a new item, accurate in detail to the original, and from either the same or a similar material as the original, unless otherwise indicated.
- K. Retain: To keep existing items that are not to be removed or dismantled.
- L. Strip: To remove existing finish down to base material unless otherwise indicated.

1.4 COORDINATION

- A. Alteration Work Subschedule: A construction schedule coordinating the sequencing and scheduling of alteration work for entire Project, including each activity to be performed, and based on Contractor's Construction Schedule. Secure time commitments for performing critical construction activities from separate entities responsible for alteration work.
 - 1. Schedule construction operations in sequence required to obtain best Work results.
 - 2. Coordinate sequence of alteration work activities to accommodate the following:
 - a. Owner's continuing occupancy of portions of existing building.

- b. Owner's partial occupancy of completed Work.
 - c. Other known work in progress.
 - d. Tests and inspections.
 - 3. Detail sequence of alteration work, with start and end dates.
 - 4. Utility Services: Indicate how long utility services will be interrupted. Coordinate shutoff, capping, and continuation of utility services.
- B. Pedestrian and Vehicular Circulation: Coordinate alteration work with circulation patterns within Project building(s) and site. Some work is near circulation patterns and adjacent to restricted areas. Circulation patterns cannot be closed off entirely and in places can be only temporarily redirected around small areas of work. Plan and execute the Work accordingly.

1.5 PROJECT MEETINGS FOR ALTERATION WORK

- A. Preliminary Conference for Alteration Work: Before starting alteration work, conduct conference at Project site.
- 1. Attendees: In addition to representatives of Owner, Architect, and Contractor, testing service representative, specialists, and chemical-cleaner manufacturer(s) shall be represented at the meeting.
 - 2. Agenda: Discuss items of significance that could affect progress of alteration work, including review of the following:
 - a. Alteration Work Subschedule: Discuss and finalize; verify availability of materials, specialists' personnel, equipment, and facilities needed to make progress and avoid delays.
 - b. Fire-prevention plan.
 - c. Governing regulations.
 - d. Areas where existing construction is to remain and the required protection.
 - e. Hauling routes.
 - f. Sequence of alteration work operations.
 - g. Storage, protection, and accounting for salvaged and specially fabricated items.
 - h. Existing conditions, staging, and structural loading limitations of areas where materials are stored.
 - i. Qualifications of personnel assigned to alteration work and assigned duties.
 - j. Requirements for extent and quality of work, tolerances, and required clearances.
 - k. Embedded work such as flashings and lintels, special details, collection of waste, protection of occupants and the public, and condition of other construction that affects the Work or will affect the work.
 - 3. Reporting: Record conference results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from conference.
- B. Coordination Meetings: Conduct coordination meetings specifically for alteration work at weekly intervals. Coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
- 1. Attendees: In addition to representatives of Owner, Architect, and Contractor, each specialist, supplier, installer, and other entity concerned with progress or involved in planning, coordination, or performance of alteration work activities shall be represented at these meetings. All participants at conference shall be familiar with Project and authorized to conclude matters relating to alteration work.
 - 2. Agenda: Review and correct or approve minutes of previous coordination meeting. Review other items of significance that could affect progress of alteration work. Include topics for discussion as appropriate to status of Project.

- a. Alteration Work Subschedule: Review progress since last coordination meeting. Determine whether each schedule item is on time, ahead of schedule, or behind schedule. Determine how construction behind schedule will be expedited with retention of quality; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities are completed within the Contract Time.
- b. Schedule Updating: Revise Contractor's Alteration Work Subschedule after each coordination meeting where revisions to schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
- c. Review present and future needs of each entity present, including review items listed in the "Preliminary Conference for Alteration Work" Paragraph in this article and the following:
 - 1) Interface requirements of alteration work with other Project Work.
 - 2) Status of submittals for alteration work.
 - 3) Access to alteration work locations.
 - 4) Effectiveness of fire-prevention plan.
 - 5) Quality and work standards of alteration work.
 - 6) Change Orders for alteration work.
3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.6 MATERIALS OWNERSHIP

- A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered or uncovered during the Work, regardless of whether they were previously documented, remain Owner's property.
 1. Carefully dismantle and salvage each item or object in a manner to prevent damage and protect it from damage, then promptly deliver it to Owner where directed at Project site.

1.7 INFORMATIONAL SUBMITTALS

- A. Alteration Work Subschedule:
 1. Submit alteration work subschedule within seven days of date established for commencement of alteration work.
- B. Preconstruction Documentation: Show preexisting conditions of adjoining construction and site improvements that are to remain, including finish surfaces, that might be misconstrued as damage caused by Contractor's alteration work operations.

1.8 QUALITY ASSURANCE

- A. Specialist Qualifications: An experienced firm regularly engaged in specialty work similar in nature, materials, design, and extent to alteration work as specified in each Section and that has completed a minimum of recent projects with a record of successful in-service performance that demonstrates the firm's qualifications to perform this work.
 1. Field Supervisor Qualifications: Full-time supervisors experienced in specialty work similar in nature, material, design, and extent to that indicated for this Project. Supervisors shall be on-site when specialty work begins and during its progress. Supervisors shall not be changed during Project except for causes beyond the control of the specialist firm.
 - a. Construct new mockups of required work whenever a supervisor is replaced.

- B. Title X Requirement: Each firm conducting activities that disturb painted surfaces shall be a "Lead-Safe Certified Firm" according to 40 CFR 745, Subpart E, and use only workers that are trained in lead-safe work practices.
- C. Alteration Work Program: Prepare a written plan for alteration work for whole Project, including each phase or process and protection of surrounding materials during operations. Show compliance with indicated methods and procedures specified in this and other Sections. Coordinate this whole-Project alteration work program with specific requirements of programs required in other alteration work Sections.
 - 1. Dust and Noise Control: Include locations of proposed temporary dust- and noise-control partitions and means of egress from occupied areas coordinated with continuing on-site operations and other known work in progress.
 - 2. Debris Hauling: Include plans clearly marked to show debris hauling routes, turning radii, and locations and details of temporary protective barriers.
- D. Fire-Prevention Plan: Prepare a written plan for preventing fires during the Work, including placement of fire extinguishers, fire blankets, rag buckets, and other fire-control devices during each phase or process. Coordinate plan with Owner's fire-protection equipment and requirements. Include fire-watch personnel's training, duties, and authority to enforce fire safety.
- E. Safety and Health Standard: Comply with ANSI/ASSE A10.6.

1.9 STORAGE AND HANDLING OF SALVAGED MATERIALS

- A. Salvaged Materials:
 - 1. Clean loose dirt and debris from salvaged items unless more extensive cleaning is indicated.
 - 2. Pack or crate items after cleaning; cushion against damage during handling. Label contents of containers.
 - 3. Store items in a secure area until delivery to Owner.
 - 4. Transport items to Owner's storage area on-site.
 - 5. Protect items from damage during transport and storage.
- B. Salvaged Materials for Reinstallation:
 - 1. Repair and clean items for reuse as indicated.
 - 2. Protect items from damage during transport and storage.
 - 3. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment unless otherwise indicated. Provide connections, supports, and miscellaneous materials to make items functional for use indicated.
- C. Existing Materials to Remain: Protect construction indicated to remain against damage and soiling from construction work. Where permitted by Architect, items may be dismantled and taken to a suitable, protected storage location during construction work and reinstalled in their original locations after alteration and other construction work in the vicinity is complete.
- D. Storage: Catalog and store items within a weathertight enclosure where they are protected from moisture, weather, condensation, and freezing temperatures.
 - 1. Identify each item for reinstallation with a nonpermanent mark to document its original location. Indicate original locations on plans, elevations, sections, or photographs by annotating the identifying marks.
 - 2. Secure stored materials to protect from theft.

3. Control humidity so that it does not exceed 85 percent. Maintain temperatures 5 deg F or more above the dew point.
 - E. Storage Space:
 1. Owner will arrange for limited on-site location(s) for free storage of salvaged material. This storage space does not include security and climate control for stored material.
- 1.10 FIELD CONDITIONS
- A. Survey of Existing Conditions: Record existing conditions that affect the Work by use of preconstruction photographs.
 1. Comply with requirements specified in Section 013233 "Photographic Documentation."
 - B. Discrepancies: Notify Architect of discrepancies between existing conditions and Drawings before proceeding with removal and dismantling work.

PART 2 - PRODUCTS - (Not Used)

PART 3 - EXECUTION

3.1 PROTECTION

- A. Protect persons, motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm resulting from alteration work.
 1. Use only proven protection methods, appropriate to each area and surface being protected.
 2. Provide temporary barricades, barriers, and directional signage to exclude the public from areas where alteration work is being performed.
 3. Erect temporary barriers to form and maintain fire-egress routes.
 4. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during alteration work.
 5. Contain dust and debris generated by alteration work, and prevent it from reaching the public or adjacent surfaces.
 6. Provide shoring, bracing, and supports as necessary. Do not overload structural elements.
 7. Protect floors and other surfaces along hauling routes from damage, wear, and staining.
- B. Temporary Protection of Materials to Remain:
 1. Protect existing materials with temporary protections and construction. Do not remove existing materials unless otherwise indicated.
 2. Do not attach temporary protection to existing surfaces except as indicated as part of the alteration work program.
- C. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.
- D. Utility and Communications Services:
 1. Notify Owner, Architect, authorities having jurisdiction, and entities owning or controlling wires, conduits, pipes, and other services affected by alteration work before commencing operations.
 2. Disconnect and cap pipes and services as required by authorities having jurisdiction, as required for alteration work.

3. Maintain existing services unless otherwise indicated; keep in service, and protect against damage during operations. Provide temporary services during interruptions to existing utilities.
- E. Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin work in an area until the drainage system is functioning properly.
 1. Prevent solids such as adhesive or mortar residue or other debris from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from alteration work.
 2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.

3.2 PROTECTION FROM FIRE

- A. General: Follow fire-prevention plan and the following:
 1. Comply with NFPA 241 requirements unless otherwise indicated.
 2. Remove and keep area free of combustibles, including rubbish, paper, waste, and chemicals, unless necessary for the immediate work.
 - a. If combustible material cannot be removed, provide fire blankets to cover such materials.
- B. Heat-Generating Equipment and Combustible Materials: Comply with the following procedures while performing work with heat-generating equipment or combustible materials, including welding, torch-cutting, soldering, brazing, removing paint with heat, or other operations where open flames or implements using high heat or combustible solvents and chemicals are anticipated:
 1. Obtain Owner's approval for operations involving use of open-flame or welding or other high-heat equipment. [**Use of open-flame equipment is not permitted.**] Notify Owner at least 72 hours before each occurrence, indicating location of such work.
 2. As far as practicable, restrict heat-generating equipment to shop areas or outside the building.
 3. Do not perform work with heat-generating equipment in or near rooms or in areas where flammable liquids or explosive vapors are present or thought to be present. Use a combustible gas indicator test to ensure that the area is safe.
 4. Use fireproof baffles to prevent flames, sparks, hot gases, or other high-temperature material from reaching surrounding combustible material.
 5. Prevent the spread of sparks and particles of hot metal through open windows, doors, holes, and cracks in floors, walls, ceilings, roofs, and other openings.
 6. Fire Watch: Before working with heat-generating equipment or combustible materials, station personnel to serve as a fire watch at each location where such work is performed. Fire-watch personnel shall have the authority to enforce fire safety. Station fire watch according to NFPA 51B, NFPA 241, and as follows:
 - a. Train each fire watch in the proper operation of fire-control equipment and alarms.
 - b. Prohibit fire-watch personnel from other work that would be a distraction from fire-watch duties.
 - c. Cease work with heat-generating equipment whenever fire-watch personnel are not present.
 - d. Have fire-watch personnel perform final fire-safety inspection each day beginning no sooner than 30 minutes after conclusion of work in each area to detect hidden or smoldering fires and to ensure that proper fire prevention is maintained.

- e. Maintain fire-watch personnel at each area of Project site until 60 minutes after conclusion of daily work.
 - C. Fire-Control Devices: Provide and maintain fire extinguishers, fire blankets, and rag buckets for disposal of rags with combustible liquids. Maintain each as suitable for the type of fire risk in each work area. Ensure that nearby personnel and the fire-watch personnel are trained in fire-extinguisher and blanket use.
 - D. Sprinklers: Where sprinkler protection exists and is functional, maintain it without interruption while operations are being performed. If operations are performed close to sprinklers, shield them temporarily with guards.
 - 1. Remove temporary guards at the end of work shifts, whenever operations are paused, and when nearby work is complete.
- 3.3 PROTECTION DURING APPLICATION OF CHEMICALS
- A. Protect motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm or spillage resulting from applications of chemicals and adhesives.
 - B. Cover adjacent surfaces with protective materials that are proven to resist chemicals selected for Project unless chemicals being used will not damage adjacent surfaces as indicated in alteration work program. Use covering materials and masking agents that are waterproof and UV resistant and that will not stain or leave residue on surfaces to which they are applied. Apply protective materials according to manufacturer's written instructions. Do not apply liquid masking agents or adhesives to painted or porous surfaces. When no longer needed, promptly remove protective materials.
 - C. Do not apply chemicals during winds of sufficient force to spread them to unprotected surfaces.
 - D. Neutralize alkaline and acid wastes and legally dispose of off Owner's property.
 - E. Collect and dispose of runoff from chemical operations by legal means and in a manner that prevents soil contamination, soil erosion, undermining of paving and foundations, damage to landscaping, or water penetration into building interior.
- 3.4 GENERAL ALTERATION WORK
- A. Have specialty work performed only by qualified specialists.
 - B. Ensure that supervisory personnel are present when work begins and during its progress.
 - C. Record existing work before each procedure (preconstruction), and record progress during the work. Use digital preconstruction documentation photographs. Comply with requirements in Section 013233 "Photographic Documentation."
 - D. Perform surveys of Project site as the Work progresses to detect hazards resulting from alterations.
 - E. Notify Architect of visible changes in the integrity of material or components whether from environmental causes including biological attack, UV degradation, freezing, or thawing or from structural defects including cracks, movement, or distortion.
 - 1. Do not proceed with the work in question until directed by Architect.

END OF SECTION 013516

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 DEFINITIONS

- A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, 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.
- B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.
 - 1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).
- 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. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.
- E. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).
- F. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" shall have the same meaning as the term "testing agency."

- G. 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.
- H. 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. Contractor's quality-control services do not include contract administration activities performed by Architect.

1.4 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Statement: Submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.5 CONFLICTING REQUIREMENTS

- A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification 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.

1.6 INFORMATIONAL SUBMITTALS

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. Qualification Data: For Contractor's quality-control personnel.
- C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:
 - 1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
 - 2. Primary wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.

- D. 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 a recent report on the inspection of the testing agency by a recognized authority.
- E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Entity responsible for performing tests and inspections.
 - 3. Description of test and inspection.
 - 4. Identification of applicable standards.
 - 5. Identification of test and inspection methods.
 - 6. Number of tests and inspections required.
 - 7. Time schedule or time span for tests and inspections.
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.
- F. Reports: Prepare and submit certified written reports and documents as specified.
- G. Permits, Licenses, and Certificates: For Owner's record, 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 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities and to coordinate Owner's quality-assurance and quality-control activities. Coordinate with Contractor's Construction Schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
 - 1. Project quality-control manager may also serve as Project superintendent
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
 - 1. Contractor-performed tests and inspections, including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections. Distinguish source quality-control tests and inspections from field quality-control tests and inspections.
 - 2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections.
 - 3. Owner-performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by Commissioning Authority.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and

inspection specified. Indicate types of corrective actions to be required to bring the Work into compliance with standards of workmanship established by Contract requirements and approved mockups.

- F. Monitoring and Documentation: Maintain testing and inspection reports, including log of approved and rejected results. Include Work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming Work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

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

5. Other required items indicated in individual Specification Sections.

1.9 QUALITY ASSURANCE

- A. 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. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.
- 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, applying, 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 is similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged in the activities indicated.
 - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. 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 Contractor's responsibilities, including the following:
 - 1. Provide test specimens representative of proposed products and construction.

2. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
3. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
4. Build site-assembled test assemblies and mockups, using installers who will perform same tasks for Project.
5. Build laboratory mockups at testing facility, using personnel, products, and methods of construction indicated for the completed Work.
6. When testing is complete, remove test specimens and test assemblies,] do not reuse products on Project.
7. 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.

1.10 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 Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
 1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 2. Engage a qualified testing agency to perform quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- D. Testing Agency Responsibilities: Cooperate with Architect Construction Manager, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 1. Notify Architect , Construction Manager, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Determine the locations 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 Contractor.
 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 duties of Contractor.
- E. 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."
- F. 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.
- G. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives 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 inspection. 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 inspection equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

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 Construction Manager's reference during normal working hours.
 - 1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspection, 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 Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- 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": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- 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.

1.3 INDUSTRY STANDARDS

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

1.4 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 Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."
- 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. The information in this list is subject to change and is believed to be accurate as of the date of the Contract Documents.
1. AABC - Associated Air Balance Council; www.aabc.com.
 2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
 3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
 4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
 5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
 6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
 7. ABMA - American Boiler Manufacturers Association; www.abma.com.
 8. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
 9. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
 10. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
 11. AF&PA - American Forest & Paper Association; www.afandpa.org.
 12. AGA - American Gas Association; www.aga.org.
 13. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
 14. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
 15. AI - Asphalt Institute; www.asphaltinstitute.org.
 16. AIA - American Institute of Architects (The); www.aia.org.
 17. AISC - American Institute of Steel Construction; www.aisc.org.
 18. AISI - American Iron and Steel Institute; www.steel.org.
 19. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
 20. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
 21. ANSI - American National Standards Institute; www.ansi.org.
 22. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
 23. APA - APA - The Engineered Wood Association; www.apawood.org.
 24. APA - Architectural Precast Association; www.archprecast.org.
 25. API - American Petroleum Institute; www.api.org.
 26. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
 27. ARI - American Refrigeration Institute; (See AHRI).
 28. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
 29. ASCE - American Society of Civil Engineers; www.asce.org.
 30. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
 31. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
 32. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
 33. ASSE - American Society of Safety Engineers (The); www.asse.org.
 34. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
 35. ASTM - ASTM International; www.astm.org.

36. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
37. AWEA - American Wind Energy Association; www.awea.org.
38. AWI - Architectural Woodwork Institute; www.awinet.org.
39. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
40. AWWPA - American Wood Protection Association; www.awpa.com.
41. AWS - American Welding Society; www.aws.org.
42. AWWA - American Water Works Association; www.awwa.org.
43. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
44. BIA - Brick Industry Association (The); www.gobrick.com.
45. BICSI - BICSI, Inc.; www.bicsi.org.
46. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.org.
47. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
48. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bissc.org.
49. CDA - Copper Development Association; www.copper.org.
50. CE - Conformite Europeenne; <http://ec.europa.eu/growth/single-market/ce-marking/>.
51. CEA - Canadian Electricity Association; www.electricity.ca.
52. CEA - Consumer Electronics Association; www.ce.org.
53. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
54. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
55. CGA - Compressed Gas Association; www.cganet.com.
56. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
57. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
58. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
59. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
60. CPA - Composite Panel Association; www.pbmdf.com.
61. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
62. CRRC - Cool Roof Rating Council; www.coolroofs.org.
63. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
64. CSA - CSA Group; www.csagroup.com.
65. CSA - CSA International; www.csa-international.org.
66. CSI - Construction Specifications Institute (The); www.csinet.org.
67. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
68. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.cti.org.
69. CWC - Composite Wood Council; (See CPA).
70. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
71. DHI - Door and Hardware Institute; www.dhi.org.
72. ECA - Electronic Components Association; (See ECIA).
73. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
74. ECIA - Electronic Components Industry Association; www.eciaonline.org.
75. EIA - Electronic Industries Alliance; (See TIA).
76. EIMA - EIFS Industry Members Association; www.eima.com.
77. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
78. ESD - ESD Association; (Electrostatic Discharge Association); www.esda.org.
79. ESTA - Entertainment Services and Technology Association; (See PLASA).
80. ETL - Intertek (See Intertek); www.intertek.com.
81. EVO - Efficiency Valuation Organization; www.evo-world.org.
82. FCI - Fluid Controls Institute; www.fluidcontrolsintstitute.org.

83. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
84. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
85. FM Approvals - FM Approvals LLC; www.fmglobal.com.
86. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
87. FRSA - Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.; www.floridarooft.com.
88. FSA - Fluid Sealing Association; www.fluidsealing.com.
89. FSC - Forest Stewardship Council U.S.; www.fscus.org.
90. GA - Gypsum Association; www.gypsum.org.
91. GANA - Glass Association of North America; www.glasswebsite.com.
92. GS - Green Seal; www.greenseal.org.
93. HI - Hydraulic Institute; www.pumps.org.
94. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
95. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
96. HPVA - Hardwood Plywood & Veneer Association; www.hpva.org.
97. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
98. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
99. IAS - International Accreditation Service; www.iasonline.org.
100. ICBO - International Conference of Building Officials; (See ICC).
101. ICC - International Code Council; www.iccsafe.org.
102. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
103. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
104. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
105. IEC - International Electrotechnical Commission; www.iec.ch.
106. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
107. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
108. IESNA - Illuminating Engineering Society of North America; (See IES).
109. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
110. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
111. IGSHA - International Ground Source Heat Pump Association; www.igshpa.okstate.edu.
112. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
113. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
114. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
115. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
116. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
117. ISO - International Organization for Standardization; www.iso.org.
118. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
119. ITU - International Telecommunication Union; www.itu.int/home.
120. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
121. LMA - Laminating Materials Association; (See CPA).
122. LPI - Lightning Protection Institute; www.lightning.org.
123. MBMA - Metal Building Manufacturers Association; www.mbma.com.
124. MCA - Metal Construction Association; www.metalconstruction.org.

125. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
126. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
127. MHIA - Material Handling Industry of America; www.mhia.org.
128. MIA - Marble Institute of America; www.marble-institute.com.
129. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
130. MPI - Master Painters Institute; www.paintinfo.com.
131. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
132. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
133. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
134. NADCA - National Air Duct Cleaners Association; www.nadca.com.
135. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
136. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
137. NBI - New Buildings Institute; www.newbuildings.org.
138. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
139. NCMA - National Concrete Masonry Association; www.ncma.org.
140. NEBB - National Environmental Balancing Bureau; www.nebb.org.
141. NECA - National Electrical Contractors Association; www.necanet.org.
142. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
143. NEMA - National Electrical Manufacturers Association; www.nema.org.
144. NETA - InterNational Electrical Testing Association; www.netaworld.org.
145. NFHS - National Federation of State High School Associations; www.nfhs.org.
146. NFPA - National Fire Protection Association; www.nfpa.org.
147. NFPA - NFPA International; (See NFPA).
148. NFRC - National Fenestration Rating Council; www.nfrc.org.
149. NHLA - National Hardwood Lumber Association; www.nhla.com.
150. NLGA - National Lumber Grades Authority; www.nlga.org.
151. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
152. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
153. NRCA - National Roofing Contractors Association; www.nrca.net.
154. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
155. NSF - NSF International; www.nsf.org.
156. NSPE - National Society of Professional Engineers; www.nspe.org.
157. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
158. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
159. NWFA - National Wood Flooring Association; www.nwfa.org.
160. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
161. PDI - Plumbing & Drainage Institute; www.pdionline.org.
162. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
163. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
164. RFCI - Resilient Floor Covering Institute; www.rfci.com.
165. RIS - Redwood Inspection Service; www.redwoodinspection.com.
166. SAE - SAE International; www.sae.org.
167. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
168. SDI - Steel Deck Institute; www.sdi.org.
169. SDI - Steel Door Institute; www.steeldoor.org.
170. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.

171. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
172. SIA - Security Industry Association; www.siaonline.org.
173. SJI - Steel Joist Institute; www.steeljoist.org.
174. SMA - Screen Manufacturers Association; www.smainfo.org.
175. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
176. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
177. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
178. SPIB - Southern Pine Inspection Bureau; www.spib.org.
179. SPRI - Single Ply Roofing Industry; www.spri.org.
180. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
181. SSINA - Specialty Steel Industry of North America; www.ssina.com.
182. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
183. STI - Steel Tank Institute; www.steeltank.com.
184. SWI - Steel Window Institute; www.steelwindows.com.
185. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
186. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
187. TCNA - Tile Council of North America, Inc.; www.tileusa.com.
188. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
189. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
190. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
191. TMS - The Masonry Society; www.masonrysociety.org.
192. TPI - Truss Plate Institute; www.tpinst.org.
193. TPI - Turfgrass Producers International; www.turfgrasssod.org.
194. TRI - Tile Roofing Institute; www.tilerroofing.org.
195. UL - Underwriters Laboratories Inc.; www.ul.com.
196. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
197. USAV - USA Volleyball; www.usavolleyball.org.
198. USGBC - U.S. Green Building Council; www.usgbc.org.
199. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
200. WA - Wallcoverings Association; www.wallcoverings.org.
201. WASTEC - Waste Equipment Technology Association; www.wastec.org.
202. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
203. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
204. WDMA - Window & Door Manufacturers Association; www.wdma.com.
205. WI - Woodwork Institute; www.wicnet.org.
206. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
207. WWPA - Western Wood Products Association; www.wwpa.org.

- 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. This information is believed to be accurate as of the date of the Contract Documents.
1. DIN - Deutsches Institut für Normung e.V.; www.din.de.
 2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
 3. ICC - International Code Council; www.iccsafe.org.

4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.
- 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. Information is subject to change and is up to date as of the date of the Contract Documents.
1. COE - Army Corps of Engineers; www.usace.army.mil.
 2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
 3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
 4. DOD - Department of Defense; www.quicksearch.dla.mil.
 5. DOE - Department of Energy; www.energy.gov.
 6. EPA - Environmental Protection Agency; www.epa.gov.
 7. FAA - Federal Aviation Administration; www.faa.gov.
 8. FG - Federal Government Publications; www.gpo.gov/fdsys.
 9. GSA - General Services Administration; www.gsa.gov.
 10. HUD - Department of Housing and Urban Development; www.hud.gov.
 11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.
 12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
 13. SD - Department of State; www.state.gov.
 14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
 15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
 16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
 17. USDOJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
 18. USP - U.S. Pharmacopeial Convention; www.usp.org.
 19. USPS - United States Postal Service; www.usps.com.
- 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. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
 2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.quicksearch.dla.mil.
 3. DSCC - Defense Supply Center Columbus; (See FS).
 4. FED-STD - Federal Standard; (See FS).
 5. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.
 - a. Available from Defense Standardization Program; www.dsp.dla.mil.
 - b. Available from General Services Administration; www.gsa.gov.
 - c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org.
 6. MILSPEC - Military Specification and Standards; (See DOD).
 7. USAB - United States Access Board; www.access-board.gov.
 8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

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. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
3. CDHS; California Department of Health Services; (See CDPH).
4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cal-iaq.org.
5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
6. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; www.txforestservation.tamu.edu.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 014529 - TESTING LAB SERVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control related to tests and inspections performed by District's Testing Agency.
- B. Testing and inspection services specified in this Section will be performed by a Testing Agency selected and employed by the District.
- C. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and -control services required by other Sections are not limited by provisions of this Section.
- D. Related Requirements:
 - 1. Section 014000 "Quality Requirements"
 - 2. Section 017300 "Execution."

1.3 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 District.
- C. Testing Agency: For this Section, an entity engaged by the District to perform specific tests, inspections, or both.

1.4 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, District will comply with the most stringent requirement.
- 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.

1.5 INFORMATIONAL SUBMITTALS

- A. Schedule of Tests and Inspections: District will prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Description of test and inspection.
 - 3. Number of tests and inspections required.
 - 4. Time schedule or time span for tests and inspections.
 - 5. Requirements for obtaining samples.

1.6 QUALITY ASSURANCE

- A. Testing and inspections required by governing authorities will be performed by an independent testing laboratory selected and employed by the District and approved by the Division of the State Architect (DSA). Qualification of a testing agency or laboratory will be under the jurisdiction of the DSA Office of Regulations (ORS) Structural Safety Section (SSS) when applicable. Procedural and acceptance criteria are set forth in CBC Sections 110 and 1701A, and California Code of Regulations (CBC) Title 24 Part 1, Administrative Code, and the DSA Interpretation of Regulations.
- B. Testing and inspection services which are performed will be in accordance with requirements of CBC Title 24 Part 1, Administrative Code, and as specified herein.
- C. When specified, testing and inspections not required by governing authorities (NON-DSA) will also be performed by an independent Testing Agency selected and employed by the District.
- D. Testing and inspection services will verify that work meets the requirements of the Contract Documents.
- E. In general, tests and inspections for structural materials shall include all items enumerated on the Statement of Structural Tests and Special Inspections (DSA Form 103) for this project as prepared and distributed by the Architect.
- F. Testing Agency will submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, District Construction Manager, and Project Inspector, with copy to Contractor. Testing Agency will interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 - 1. Testing Agency will notify Architect, District Construction Manager, Project Inspector and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 - 2. Testing Agency will submit a certified written report of each test, inspection, and similar quality-control service to Architect, District Construction Manager, and Project Inspector, with copy to Contractor and to authorities having jurisdiction.
 - 3. Testing Agency will interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 - 4. Testing Agency will retest and reinspect corrected work.
 - 5. Testing Agency will not release, revoke, alter, or increase requirements of the Contract Documents or approve or accept any portion of the Work.
 - 6. Testing Agency will not perform any duties of the Contractor.

- G. Test reports will include all tests made, regardless of whether such tests indicate that the material is satisfactory or unsatisfactory. Samples taken but not tested will also be reported. Records of special sampling operations as required shall also be reported. The reports shall show that the material or materials were sampled and tested in accordance with the requirements of CBC Title 24 Part 1 Administrative Code, Part 2 California Building Code, and with the DSA approved specifications. They will also state definitely whether or not the material or materials tested comply with requirements.
- H. Reporting Test Failures:
 - 1. Immediately upon Testing Agency determination of a test failure, the Agency will notify Contractor and other interested parties.

1.7 PAYMENTS

- A. Costs of initial testing and inspection, except as specifically modified herein, or specified otherwise in technical sections, will be paid by the District. Initial tests and inspections are defined as the first tests and inspections as herein specified.
- B. In the event a test or inspection indicates failure of a material or procedure to meet requirements of Contract Documents, costs for retesting and additional work related to failure will be paid by the District and backcharged to the Contractor.
- C. Additional tests and inspections, not herein specified but requested by District or Architect, will be paid by District unless results of such tests and inspections are found to be not in compliance with Contract Documents, in which case the District will pay all costs for initial testing as well as retesting, reinspection and additional work related to non-compliance. District will then backcharge the Contractor for these costs.
- D. Costs for additional tests or inspections required because Contractor changed materials or changed source or supply will be paid by District and backcharged to the Contractor.
- E. Costs for tests or inspections that are required to correct deficiencies will be paid by the District and backcharged to the Contractor.
- F. Extra Testing Agency expenses resulting from a failure to notify the Testing Agency will be paid by the District and backcharged to the Contractor.
- G. Charges due to insufficient advance notice of cancellations or time extension will be paid for by the District and backcharged to the Contractor.
- H. Cost of testing that is required solely for the convenience of Contractor in his scheduling and performance of work will be paid by the District and backcharged to the Contractor.
- I. Overtime costs for testing and inspections performed outside the regular work day hours, including weekends and holidays, due to fault of Contractor will be paid for by the District and backcharged to the Contractor. Such costs include overtime costs for the District's personnel.
- J. Should it be considered necessary or advisable by the District at any time before final acceptance of the entire work to make an examination of work already completed by removing or tearing out the completed work, the Contractor shall on request promptly furnish necessary facilities, labor and materials. If such work is found to be defective in any respect due to fault of the Contractor or his subcontractor, Contractor shall be responsible for all expenses of such examinations and of satisfactory reconstruction. If, however, such work is found to meet the requirements of the Contract, the additional cost of labor and material necessarily involved in the examination and replacement shall be reimbursed to the Contractor.

1.8 QUALITY CONTROL

- A. Contractor Responsibilities:
 - 1. Notify District Construction Manager and Testing Agencies at least 48 hours in advance of time when Work that requires testing or inspecting will be performed.
 - 2. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 - 3. 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 Contractor and the Contract Sum will be adjusted by Change Order.
- B. Contractor Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify Testing 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. Preliminary design mix proposed for use for material mixes that require control by Testing Agency.
 - 6. Security and protection for samples and for testing and inspecting equipment at Project site.
 - 7. Selection of the material required to be tested will be by the Testing Agency or the District and not by the Contractor.
- C. Contractor shall notify the Testing Agency a minimum of 3 working days in advance of the manufacture of material to be supplied by him under the Contract Documents, which must by terms of the Contract be tested, in order that the Agency may arrange for the testing of such material at the source of supply.
 - 1. Material shipped by the Contractor from the source of supply before having satisfactorily passed such testing and inspection or before the receipt of notice from the District that such testing and inspection will not be required, shall not be incorporated in the Project.
- D. Coordinate sequence of activities to accommodate required quality-assurance and quality-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 PROJECT INSPECTOR

- A. An Inspector employed by the District in accordance with the requirements of CBC Title 24 Part 1, Administrative Code, will be assigned to the work. His duties are specifically defined in CBC Title 24 Part 1, Sec. 4-342.
- B. The Contractor shall notify the Inspector a minimum of two working days in advance of execution of all work that requires inspection.
- C. The work of construction in all stages of progress shall be subject to the personal continuous observation of the Inspector. Inspector shall have free access to any or all parts of the work at any time. The Contractor shall furnish the Inspector reasonable facilities for obtaining such information as may be necessary to be fully informed respecting the progress and manner of the

work and the character of the materials. Inspection of the work shall not relieve the Contractor from any obligation to comply with the Contract requirements.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 DSA TESTS AND INSPECTIONS

- A. Test and inspections for the following will be performed in conformance with the California Building Code, Title 24, Part 2, of the California Code of Regulations, and the DSA Interpretations of Regulations (IR) Manual.
- B. Structural tests and inspections will be performed in accordance with CBC Chapter 17A.
- C. Soils (CBC Chapter 18A).
 - 1. General: CBC Table 1705A.6.
 - a. Verification of site preparation
 - 2. Compacted Fills: CBC Table 1705A.6.
 - a. Qualification of fill materials.
 - b. Inspect placement.
 - 3. Driven Deep Foundations (Piles): CBC Table 1705A.7.
 - a. Verify materials, sizes, lengths.
 - b. Load tests.
 - c. Inspect driving operations.
 - d. Verify locations, plumbness, penetrations.
 - 4. Cast-In-Place Deep Foundations (Piers): CBC Table 1705A.8.
 - a. Inspect drilling operations.
 - b. Verify locations.
 - c. Confirm diameters, plumbness, embedment.
 - d. Confirm bearing capacity.
 - 5. Retaining Walls:
 - a. Backfill: CBC Table 1705A.6.1
- D. Concrete (CBC Chapter 19A).
 - 1. Cast-In-Place Concrete: CBC Table 1705A.3.
 - a. Material Verification and Testing:
 - 1) Design Mix: verification.
 - 2) Reinforcing Steel: CBC Section 1910A.2; ASTM A370; DSA IR 17-10.
 - 3) Slump, Temperature, Air Content: ASTM C172; ASTM C31.
 - 4) Compression: ACI 318 Section 5.6; CBC Section 1905A.1.2; ASTM C39.
 - b. Inspection:
 - 1) Batch Plant Inspection: CBC Section 1705A.3.2.
 - 2) Batch Plant Inspection: CBC Section 1705A.3.3.
 - 3) Placement of formwork, reinforcing steel, embedded items.
 - 4) Verify concrete strength prior to removal of forms.
 - 2. Prestressed Concrete:
 - a. Test prestressing tendons and anchorages: CBC Section 1705A.3.
 - b. Inspect placement of prestressing tendons.
 - c. Verify concrete strength prior to stressing of tendons.
 - d. Inspect application of prestressing forces and grouting of tendons.
 - 3. Precast Concrete:

- a. Inspect fabrication of precast members.
 - b. Inspect erection of precast members.
- 4. Shotcrete:
 - a. Inspect shotcrete placement: CBC Section 1705A.19.
 - b. Test shotcrete compression: CBC Sections 1908A.5, 1908A.10, and 1910A.5; ASTM C42; ASTM C1140.
- 5. Post-Installed Anchors:
 - a. Inspect installation: CBC Table 1705A.3.
 - b. Test post-installed anchors: CBC Section 1910A.5.
- E. Masonry (CBC Chapter 21A and TMS 402-11/ACI 530-11/ASCE 5-11 Table 1.19.3).
 - 1. Structural Masonry:
 - a. Material Verification and Testing:
 - 1) Reinforcing Steel: CBC Section 2103A.4; ASTM A370; DSA IR 17-10.
 - 2) Strength: CBC Sections 1708A.1.4 and 2105A.2.2.1; ASTM C140; ASTM C1586; ASTM C1019.
 - 3) Prism Test: CBC Section 2105A.2.2.2; ASTM C1314.
 - 4) Verify mortar and grout proportions: ASTM C780.
 - 5) Test core-drilled holes: CBC Section 2105A.4.
 - b. Mandatory Tests Required by DSA IR 21-4:
 - 1) Measurements: Per Section 5, ASTM C 140.
 - 2) Compressive Strength: Per Section 6, ASTM C 140.
 - 3) Absorption: Per Section B, ASTM C 140.
 - 4) Shrinkage of CMU: Per ASTM C 90, Section 5.2 and 8.3.
 - c. Inspection:
 - 1) Inspect preparation of prisms: ASTM C1314.
 - 2) Verify size, location, and condition of dowels.
 - 3) Verify size, grade, and type of reinforcement.
 - 4) Inspect placement of reinforcement, connectors, masonry units, mortar joints.
 - 5) Verify protection of masonry during cold or hot weather.
 - 6) Inspect type, size, and location of embedded anchor.
 - 7) Inspect grout space prior to grouting.
 - 2. Veneer or Glass Block Partitions: CBC Table 1705A.4.1.
 - a. Verify mortar and grout proportions: ASTM C780.
 - b. Inspect placement of units and construction of joints.
 - c. Inspect placement of reinforcement, connectors, anchors.
 - d. Inspect type, size, and location of anchors and other embedded items.
 - e. Verify protection of masonry during cold or hot weather.
 - 3. Post-Installed Anchors in masonry:
 - a. Inspect installation of post-installed anchors: CBC Section 1705A.4.
 - b. Test post-installed anchors: CBC Sections 1705A.4 and 1910A.5; ASTM E488.
- F. Steel (CBC Chapter 22A and CBC Table 1705A.2.1).
 - 1. Structural Steel and Cold-Formed Steel Used for Structural Purposes:
 - a. Material Verification:
 - 1) Verify markings, mill certificates, sizes, types, and grades.
 - 2) Test unidentified materials: CBC Section 2203A.1; ASTM A370.
 - 3) Examine seam welds of structural tubes and pipes: DSA IR 17-3.
 - b. Inspection:
 - 1) Verify member locations and details constructed in field.

- 2) Verify stiffener locations and details fabricated in shop.
2. High-Strength Bolts:
 - a. Material Verification:
 - 1) Verify markings and certificates of compliance: DSA IR 17-9.
 - 2) Test bolts, nuts, washers: CBC Section 2213A.1; ASTM F606; ASTM A370; DSA IR 17-8.
 - b. Inspection
 - 1) Bearing-type connections: DSA IR 17-9.
 - 2) Slip-critical connections: DSA IR 17-9.
3. Welding: DSA IR 17-3; AWS D1.1; AWS D1.8.
 - a. Verification
 - 1) Verify weld filler identification markings.
 - 2) Verify weld filler material manufacturer's certificate of compliance.
 - 3) Verify WPS, welder qualifications, and equipment: DSA IR 17-3.
 - b. Shop Welding
 - 1) Inspect groove, multi-pass, and fillet welds $>5/16''$: AISC 360; DSA IR 17-3.
 - 2) Inspect single pass fillet welds $\leq 5/16''$: AISC 360; DSA IR 17-3.
 - 3) Inspect welding of stairs and railings: CBC Section 1705A.2.2; AISC 360; DSA IR 17-3.
 - 4) Verification of reinforcing steel weldability: CBC Section 1705A.3.1; DSA IR 17-3.
 - 5) Inspect welding of reinforcing steel: CBC Sections 1705A.3.1, Table 1705A.3 Item 2 and Table 1705A.2.1 Item 5b, 1903A.8; DSA IR 17-3.
 - c. Field Welding:
 - 1) Inspect groove, multi-pass, and fillet welds $>5/16''$: AISC 360; DSA IR 17-3.
 - 2) Inspect single pass fillet welds $\leq 5/16''$: AISC 360; DSA IR 17-3.
 - 3) Inspect floor and roof deck welds: AISC 360; DSA IR 17-3.
 - 4) Inspect welding of structural cold-formed steel: CBC Sections 1705A.2.5 ; DSA IR 17-3.
 - 5) Inspect welding of stairs and railings: CBC Sections 1705A.2.1; DSA IR 17-3.
 - 6) Verification of reinforcing steel weldability: CBC Section 1705A.3.1; DSA IR 17-3.
 - 7) Inspect welding of reinforcing steel: CBC Section 1705A.3.1; Table 1705A.3 Item 2 and Table 1705A.2.1 Item 5b, 1903A.8, DSA IR 17-3.
4. Non-Destructive Testing:
 - a. Ultrasonic: AISC 341, App. Q 5.2. AWS D1.1, D1.8.- ANSI/ASNT CP-189, SNT-TC-1A. - ASTM E543, E1444, E164 - DSA IR 17-2.
 - b. Magnetic Particle: AISC 341, App. Q 5.2. AWS D1.1, D1.8.- ANSI/ASNT CP-189, SNT-TC-1A. - ASTM E543, E1444, E164 - DSA IR 17-2.
5. Steel Joists and Trusses:
 - a. Verify size, type, and grade of all members, connectors, weld filler materials: CBC Section 1705A.2.2.3 and DSA IR 22-3 for steel joists only; CBC Section 1705A.2.2.4 for steel trusses.
 - 1) Spray-Applied Fireproofing:
 - b. Examine surfaces, inspect application, take samples, measure thickness; CBC Section 1705A.13; ASTM E605.
 - c. Test bond strength: CBC Section 1705A.13.6; ASTM E736.

- d. Test density: CBC Section 1705A.13.5; ASTM E605.
 - 6. Other Steel:
 - a. High-Strength Threaded Rods: CBC Section 2212A.1.
 - G. Wood (CBC Chapter 23)
 - 1. Prefabricated Wood Structural Elements: CBC Section 1705A.5.
 - a. Inspect fabrication of structural glued-laminated timber.
 - b. Inspect fabrication of manufactured open-web trusses: CBC Section 1705A.5.5; DSA IR 23-4.
 - c. Inspect fabrication of manufactured metal plate connected trusses: CBC Section 1705A.5; DS AIR 23-8.
 - H. Other
 - 1. Skylight Load Test: CBC Sections 1709A.2 and 1709A.3.
 - 2. Grounding: CEC Section 25 0. 56.
- 3.2 NON-DSA TESTS AND INSPECTIONS
- A. Concrete Floor Slabs (Section 09 05 61.13 “Moisture Vapor Emission Control”).
 - 1. Testing for Moisture Vapor:
 - a. Anhydrous calcium chloride vapor transmission tests: ASTM F1869.
 - 2. Testing for Alkalinity:
 - a. pH level tests: ASTM F710.
 - B. Playground Protective Surfacing (Section 32 18 16.13 “Playground Protective Surfacing”).
 - 1. Safety Inspection: California Health and Safety Code Section 11 57 25.
 - C. Playground Equipment (Section 11 68 00 “Play Field Equipment and Structures”).
 - 1. Safety Inspection: California health and Safety Code Section 11 57 25.
 - 2. Telescoping Stands (Section 12 66 00 “Telescoping Stands”).
 - 3. Field Inspections: DSA IR 16-5.07.
 - 4. ICC 300 Inspection: Inspect installed telescoping stands to verify that construction, installation, and operation are according to ICC 300 requirements.
 - 5. Test and adjust controls and safeties.
 - D. Grandstands and Bleachers (Section 13 34 16 “Grandstands and Bleachers”).
 - 1. Field Inspections: DSA IR 16-5.07.
 - E. Synthetic Grass surfacing:
 - 1. Compaction: Of in-place soils according to ASTM D 1556, ASTM D 2167, ASTM D 2937, and ASTM D 6938, as applicable.
 - 2. Permeability: Minimum 5 inches per hour per square foot of rainfall capacity according to ASTM F 2898 or EN 15330-1.
 - 3. Shock Attenuation: No greater than 125 G(max) at time of installation according to ASTM F 1936.
- 3.3 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 01 73 00 "Execution."

- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014529

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

1.3 USE CHARGES

- A. Installation, removal, and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.
- B. Sewer Service: Pay sewer-service use charges for sewer usage by all entities for construction operations.
- C. Water Service: Pay water-service use charges for water used by all entities for construction operations.
- D. Electric Power Service: Pay electric-power-service use charges for electricity used by all entities for construction operations.
- E. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use with metering. Provide connections and extensions of services and metering as required for construction operations.
- F. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use with metering]. Provide connections and extensions of services and metering as required for construction operations.

1.4 INFORMATIONAL SUBMITTALS

- A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.
- B. Implementation and Termination Schedule: Within 15 days of date established for commencement of the Work, submit schedule indicating implementation and termination dates of each temporary utility.
- C. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.
- D. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

- E. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.
 - 1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.
 - 2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
 - 3. Indicate methods to be used to avoid trapping water in finished work.
- F. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Include the following:
 - 1. Locations of dust-control partitions at each phase of work.
 - 2. HVAC system isolation schematic drawing.
 - 3. Location of proposed air-filtration system discharge.
 - 4. Waste-handling procedures.
- G. Noise and Vibration Control Plan: Identify construction activities that may impact the occupancy and use of existing spaces within the building or adjacent existing buildings, whether occupied by others, or occupied by the Owner. Include the following:
 - 1. Methods used to meet the goals and requirements of the Owner.
 - 2. Concrete cutting method(s) to be used.
 - 3. Location of construction devices on the site.
 - 4. Show compliance with the use and maintenance of quieted construction devices for the duration of the Project.
 - 5. Indicate activities that may disturb building occupants and that are planned to be performed during non-standard working hours as coordinated with the Owner.

1.5 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with 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 United States Access Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.6 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. 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 rails
- B. 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 galvanized-steel bases for supporting posts.
- C. Fencing Windscreen Privacy Screen: Polyester fabric scrim with grommets for attachment to chain-link fence, sized to height of fence, in color selected by Architect from manufacturer's standard colors.

2.2 TEMPORARY FACILITIES

- A. Field Offices: 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, Construction Manager, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
 - 1. Furniture required for Project-site documents, including file cabinets, plan tables, plan racks, and bookcases.
 - 2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- square tack and marker boards.
 - 3. Drinking water and private toilet.
 - 4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
 - 5. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
 - 1. Store combustible materials apart from building.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 - 2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

- C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

- A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
 - 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

3.2 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.
 - 1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."
- 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.

3.3 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
 - 1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.
- C. .
- D. 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.
- E. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash 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.
- F. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
 - 1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.
- G. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

1. Prior to commencing work, isolate the HVAC system in area where work is to be performed .
 - a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
 - b. Maintain negative air pressure within work area, using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
 2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
 3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.
- H. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
- I. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
1. Install electric power service overhead unless otherwise indicated.
- J. 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.
- K. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install WiFi cell phone access equipment and one > land-based telephone line(s) for each field office.
- a.
 2. At each telephone, post a list of important telephone numbers.
 - a. Police and fire departments.
 - b. Ambulance service.
 - c. Contractor's home office.
 - d. Contractor's emergency after-hours telephone number.
 - e. Architect's office.
 - f. Construction Manager's home office.
 - g. Engineers' offices.
 - h. Owner's office.
 - i. Principal subcontractors' field and home offices.
- L. Electronic Communication Service: Provide secure WiFi wireless connection to internet with provisions for access by Architect and Owner.
- 3.4 SUPPORT FACILITIES INSTALLATION
- A. Comply with the following:
1. Provide construction for temporary field offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible in accordance with ASTM E136. Comply with NFPA 241.
- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas on Drawings.

1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
- C. Temporary Use of Planned Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
 2. Prepare subgrade and install subbase and base for temporary roads and paved areas in accordance with Section 312000 "Earth Moving."
 3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
 4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course in accordance with Section 321216 "Asphalt Paving."
- D. 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.
- E. Parking: [Provide temporary offsite parking areas for construction personnel.
- F. Storage and Staging: Use designated areas of Project site for storage and staging needs.
- G. 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.
 2. Remove snow and ice as required to minimize accumulations.
- H. 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.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 3. Maintain and touch up signs, so they are legible at all times.
- I. Waste Disposal Facilities: Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- J. 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."
- K. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.5 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.
 - 1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.
- 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.
 - 1. Comply with work restrictions specified in Section 011000 "Summary."
- C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings .
 - 1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant-protection zones.
 - 2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
 - 3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
 - 4. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.
- D. 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.
- E. Tree and Plant Protection: Comply with requirements specified in Section 015639 "Temporary Tree and Plant Protection."
- F. 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.
- G. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people 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.
 - 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel.
- H. 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 workday.
- I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- J. Temporary Egress: Provide temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction. Provide signage directing occupants to temporary egress.

- K. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 - 1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
- L. 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. Comply with additional limits on smoking specified in other Sections.
 - 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition in accordance with 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.

3.6 MOISTURE AND MOLD CONTROL

- A. Moisture and Mold Protection: Protect stored materials and installed Work in accordance with Moisture and Mold Protection Plan.
- B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
 - 1. Protect porous materials from water damage.
 - 2. Protect stored and installed material from flowing or standing water.
 - 3. Keep porous and organic materials from coming into prolonged contact with concrete.
 - 4. Remove standing water from decks.
 - 5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
 - 1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 - 2. Keep interior spaces reasonably clean and protected from water damage.
 - 3. Periodically collect and remove waste containing cellulose or other organic matter.
 - 4. Discard or replace water-damaged material.
 - 5. Do not install material that is wet.
 - 6. Discard and replace stored or installed material that begins to grow mold.
 - 7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.
- D. Controlled Construction Period: 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. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.

3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
 - a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 > hours are considered defective and require replacing.
 - b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
 - c. Remove and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.7 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
 2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
 3. 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 015639 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.
- B. Related Requirements:
 - 1. Section 015000 "Temporary Facilities and Controls" for temporary site fencing.
 - 2. Section 311000 "Site Clearing" for removing existing trees and shrubs.

1.3 DEFINITIONS

- A. Caliper: Diameter of a trunk measured by a diameter tape at a height 6 inches above the ground for trees up to and including 4-inch size at this height and as measured at a height of 12 inches above the ground for trees larger than 4-inch size.
- B. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.
- C. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated .
- D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site .
 - 1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:
 - a. Tree-service firm's personnel, and equipment needed to make progress and avoid delays.
 - b. Arborist's responsibilities.
 - c. Quality-control program.
 - d. Coordination of Work and equipment movement with the locations of protection zones.
 - e. Trenching by hand or with air spade within protection zones.
 - f. Field quality control.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and locations of protection-zone fencing and signage, showing relation of equipment-movement routes and material storage locations with protection zones.
 - 2. Detail fabrication and assembly of protection-zone fencing and signage.

3. Indicate extent of trenching by hand or with air spade within protection zones.
 - C. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.
 1. Species and size of tree.
 2. Location on site plan. Include unique identifier for each.
 3. Reason for pruning.
 4. Description of pruning to be performed.
 5. Description of maintenance following pruning.
- 1.6 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For arborist and tree service firm.
 - B. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.
 - C. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.
 - D. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.
 1. Use sufficiently detailed photographs or video recordings.
 2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.
 - E. Quality-control program.
- 1.7 QUALITY ASSURANCE
- A. Arborist Qualifications: Certified Arborist as certified by ISA .
 - B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.
 - C. Quality-Control Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work without damaging trees and plantings. Include dimensioned diagrams for placement of protection zone fencing and signage, the arborist's and tree-service firm's responsibilities, instructions given to workers on the use and care of protection zones, and enforcement of requirements for protection zones.
- 1.8 FIELD CONDITIONS
- A. The following practices are prohibited within protection zones:
 1. Storage of construction materials, debris, or excavated material.
 2. Moving or parking vehicles or equipment.
 3. Foot traffic.
 4. Erection of sheds or structures.
 5. Impoundment of water.
 6. Excavation or other digging unless otherwise indicated.

7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- B. Do not direct vehicle or equipment exhaust toward protection zones.
- C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Backfill Soil: Stockpiled soil mixed with planting soil of suitable moisture content and granular texture for placing around tree; free of stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth.
 1. Mixture: Well-blended mix of two parts stockpiled soil to one part planting soil >.
- B. Protection-Zone Fencing: Fencing fixed in position and meeting the following requirements. Retain one or more of four fencing subparagraphs below for protection-zone fencing. Fence materials are listed in order of strongest to weakest. Retain stronger fencing where damage potential to an individual tree, group of trees, or plantings is higher. Revise post and rail diameters to suit fence height and strength required. The more expensive polymer coating may have better appearance but may be less visible to workers.
 1. Chain-Link Protection-Zone Fencing: Galvanized-steel] fencing fabricated from minimum 2-inch opening, 0.148-inch- diameter wire chain-link fabric; with pipe posts, minimum 2-3/8-inch- OD line posts, and 2-7/8-inch- OD corner and pull posts and 0.177-inch- diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system.
 - a. Height: 72 inches 96 inches .
 2. Gates: swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones; leaf width 36 inches.
- C. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes prepunched and reinforced; legibly printed with nonfading lettering and as follows:
 1. Size and Text: As shown on Drawings .
 2. Lettering: [3-inch-] high minimum, black characters on white background.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

- B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.
- C. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated. Do not exceed indicated thickness of mulch.
 - 1. Apply 2-inch uniform thickness of organic mulch unless otherwise indicated. Do not place mulch within 6 inches of tree trunks.

3.3 PROTECTION ZONES

- A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people and animals from easily entering protected areas except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.
 - 1. Chain-Link Fencing: Install to comply with ASTM F567 and with manufacturer's written instructions.
 - 2. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Architect.
 - 3. Access Gates: Install where indicated ; adjust to operate smoothly, easily, and quietly; free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Architect. Install one sign spaced approximately every 20 feet on protection-zone fencing, but no fewer than four > signs with each facing a different direction.
- C. Maintain protection zones free of weeds and trash.
- D. Maintain protection-zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete and equipment has been removed from the site.
 - 1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
 - 2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.4 EXCAVATION

- A. Trenching within Protection Zones: Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with air spade, or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots.
- B. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not

practical, cut roots approximately 3 inches back from new construction and as required for root pruning.

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

3.5 ROOT PRUNING

- A. Prune tree roots that are affected by temporary and permanent construction. Prune roots as follows:
 - 1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
 - 2. Cut Ends: Coat cut ends of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other coating formulated for use on damaged plant tissues and that is acceptable to arborist .
 - 3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
 - 4. Cover exposed roots with burlap and water regularly.
 - 5. Backfill as soon as possible according to requirements in Section 312000 "Earth Moving."
- B. Root Pruning at Edge of Protection Zone: Prune tree roots 6 inches outside of the protection zone by cleanly cutting all roots to the depth of the required excavation.
- C. Root Pruning within Protection Zone: Clear and excavate by hand or with air spade to the depth of the required excavation to minimize damage to tree root systems. If excavating by hand, use narrow-tine spading forks to comb soil to expose roots. Cleanly cut roots as close to excavation as possible.

3.6 CROWN PRUNING

- A. Prune branches that are affected by temporary and permanent construction. Prune branches as directed by arborist.
 - 1. Prune to remove only injured, broken, dying, or dead branches unless otherwise indicated. Do not prune for shape unless otherwise indicated.
 - 2. Do not remove or reduce living branches to compensate for root loss caused by damaging or cutting root system.
 - 3. Pruning Standards: Prune trees according to ANSI A300 (Part 1).
 - a. Type of Pruning: Cleaning and thinning where indicated.
- B. Unless otherwise directed by arborist and acceptable to Architect, do not cut tree leaders.
- C. Cut branches with sharp pruning instruments; do not break or chop.
- D. Do not paint or apply sealants to wounds.
- E. Provide subsequent maintenance pruning during Contract period as recommended by arborist.
- F. Chip removed branches and **dispose of off-site**.

3.7 REGRADING

- A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.
 - 1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.
- C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- D. Minor Fill within Protection Zone: Where existing grade is 2 inches or less below elevation of finish grade, fill with backfill soil. Place backfill soil in a single uncompacted layer and hand grade to required finish elevations.

3.8 FIELD QUALITY CONTROL

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

3.9 REPAIR AND REPLACEMENT

- A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations, in a manner approved by Architect.
 - 1. Submit details of proposed pruning and repairs.
 - 2. Perform repairs of damaged trunks, branches, and roots within 24 hours according to arborist's written instructions.
 - 3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.
- B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.
 - 1. Small Trees: Provide new trees of same size and species as those being replaced for each tree that measures 6 inches > or smaller in caliper size.
 - 2. Large Trees: Provide **one** new tree(s) of 6-inch 4-inch > caliper size for each tree being replaced that measures more than 6 inches] in caliper size.
- C. Excess Mulch: Rake mulched area within protection zones, being careful not to injure roots. Rake to loosen and remove mulch that exceeds a 2-inch > uniform thickness to remain.
- D. Soil Aeration: Where directed by Architect, aerate surface soil compacted during construction. Aerate 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch- diameter holes a minimum of 12 inches deep at 24 inches o.c. Backfill holes with an equal mix of augered soil and sand.

3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS

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

END OF SECTION 015639

SECTION 015723 - TEMPORARY STORM WATER POLLUTION CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Temporary stormwater pollution controls.

1.3 STORMWATER POLLUTION PREVENTION PLAN

- A. The Stormwater Pollution Prevention Plan (SWPPP) is part of the Contract Documents and is bound into this Project Manual.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site >.
 - 1. Meet with Owner, Architect, Construction Manager, and earthwork subcontractor.
 - 2. Review requirements of the SWPPP, including permitting process, worker training, and inspection and maintenance requirements.

1.5 INFORMATIONAL SUBMITTALS

- A. Stormwater Pollution Prevention Plan (SWPP): Within 15 days of date established for commencement of the Work, submit completed SWPPP.
- B. EPA authorization under the EPA's "2017 Construction General Permit (CGP)."
- C. Stormwater Pollution Prevention (SWPP) Training Log: For each individual performing Work under the SWPPP.
- D. Inspection reports.

1.6 QUALITY ASSURANCE

- A. Stormwater Pollution Prevention Plan (SWPPP) Coordinator: Experienced individual or firm with a record of successful water pollution control management coordination of projects with similar requirements.
 - 1. SWPPP Coordinator shall complete and finalize the SWPPP form.
 - 2. SWPPP Coordinator shall be responsible for inspections and maintaining of all requirements of the SWPPP.
- B. Installers: Trained as indicated in the SWPPP.

PART 2 - PRODUCTS

2.1 TEMPORARY STORMWATER POLLUTION CONTROLS

- A. Provide temporary stormwater pollution controls as required by the SWPPP.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with all best management practices, general requirements, performance requirements, reporting requirements, and all other requirements included in the SWPPP.
- B. Locate stormwater pollution controls in accordance with the SWPPP.
- C. Conduct construction as required to comply with the SWPPP and that minimize possible contamination or pollution or other undesirable effects.
 - 1. Inspect, repair, and maintain SWPPP controls during construction.
 - a. Inspect all SWPPP controls not less than every seven days, and after each occurrence of a storm event, as outlined in the SWPPP.
- D. Remove SWPPP controls at completion of construction and restore and stabilize areas disturbed during construction.

END OF SECTION 015723

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 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 011000 "Summary" for Contractor requirements related to Owner-furnished products.
 - 2. Section 012500 "Substitution Procedures" for requests for substitutions.
 - 3. Section 017700 "Closeout Procedures" for submitting warranties.

1.3 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. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.
 - 3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part 2 "Comparable Products" Article, 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.
- B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.
- C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.
- D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:

1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
 2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.
- E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 013300 "Submittal Procedures."
- F. Substitution: Refer to Section 012500 "Substitution Procedures" for definition and limitations on substitutions.
- 1.4 **QUALITY ASSURANCE**
- A. Compatibility of Options: If Contractor 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. Resolution of Compatibility Disputes between Multiple Contractors:
 - a. Contractors are responsible for providing products and construction methods compatible with products and construction methods of other contractors.
 - b. If a dispute arises between the multiple contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.
- B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.
1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
 2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:
 - a. Name of product and manufacturer.
 - b. Model and serial number.
 - c. Capacity.
 - d. Speed.
 - e. Ratings.
- 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 that products are undamaged and properly protected.

C. Storage:

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

1.6 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to 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 in the Project Manual, prepare a written document, using indicated form properly executed.
 3. See 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 meeting 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.
 6. Or Equal: For products specified by name and accompanied by the term "or equal," "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
- B. Product Selection Procedures:
1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 2. Sole 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 Contractor's convenience will not be considered.
 3. Limited List of Products: 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 Contractor's convenience will be considered unless otherwise indicated.
 4. Non-Limited List of Products: 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.
 5. Limited List of Manufacturers: 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 Contractor's convenience** will not **be considered** unless otherwise indicated.
 - a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."
 6. Non-Limited List of Manufacturers: 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.
 7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
- C. Visual Matching Specification: Where Specifications require the phrase "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 a 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 of Comparable Products: Architect will consider Contractor'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 the following requirements:
 1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
 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.
- B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Section 013300 "Submittal Procedures."
 1. Form of Approval of Submittal: As specified in Section 013300 "Submittal Procedures."
 2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- C. Submittal Requirements, Two-Step Process: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.
- D. Submittal Requirements, Single-Step Process: When acceptable to Architect, incorporate specified submittal requirements of individual Specification Section in combined submittal for comparable products. Approval by the Architect of Contractor's request for use of comparable product and of individual submittal requirements will also satisfy other submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 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's portion of the Work.
 - 6. Coordination of Owner-installed products.
 - 7. Progress cleaning.
 - 8. Starting and adjusting.
 - 9. Protection of installed construction.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for coordination of and limits on use of Project site.
 - 2. Section 013300 "Submittal Procedures" for submitting surveys.
 - 3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
 - 4. Section 024119 "Selective Demolition" for demolition and removal of selected portions of the building.

1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.4 PREINSTALLATION MEETINGS

- A. Cutting and Patching Conference: Conduct conference at Project site.
 - 1. Prior to submitting cutting and patching plan, review extent of cutting and patching anticipated and examine procedures for ensuring satisfactory result from cutting and patching work. Inform Architect and Construction Manager of scheduled meeting. Require representatives of each entity directly concerned with cutting and patching to attend, including the following:
 - a. Contractor's superintendent.
 - b. Trade supervisor responsible for cutting operations.
 - c. Trade supervisor(s) responsible for patching of each type of substrate.
 - d. Mechanical, electrical, and utilities subcontractors' supervisors, to the extent each trade is affected by cutting and patching operations.

2. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For land surveyor.
- B. Certified Surveys: Submit two copies signed by land surveyor
- C. Certificates: Submit certificate signed by land surveyor, certifying that location and elevation of improvements comply with requirements.
- D. Cutting and Patching Plan: Submit plan describing procedures **at least 10** days prior to the time cutting and patching will be performed. Include the following information:
 1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
 2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
 3. Products: List products to be used for patching and firms or entities that will perform patching work.
 4. Dates: Indicate when cutting and patching will be performed.
 5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
 - a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.
- E. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.6 CLOSEOUT SUBMITTALS

- A. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.7 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. Professional Engineer Qualifications: Refer to Section 014000 "Quality Requirements."
- C. 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, or when encountering the need for cutting and patching of elements whose structural function is not known, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements 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. Operational elements include the following:

- a. Primary operational systems and equipment.
 - b. Fire separation assemblies.
 - c. Air or smoke barriers.
 - d. Fire-suppression systems.
 - e. Plumbing piping systems.
 - f. Mechanical systems piping and ducts.
 - g. Control systems.
 - h. Communication systems.
 - i. Fire-detection and -alarm systems.
 - j. Conveying systems.
 - k. Electrical wiring systems.
 - l. Operating systems of special construction.
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. Other construction elements include but are not limited to the following:
- a. Water, moisture, or vapor barriers.
 - b. Membranes and flashings.
 - c. Exterior curtain-wall construction.
 - d. Sprayed fire-resistive material.
 - e. Equipment supports.
 - f. Piping, ductwork, vessels, and equipment.
 - g. Noise- and vibration-control elements and systems.
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.
- D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. 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. Use materials that are not considered hazardous.
- B. 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.
- 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

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, and other construction affecting the Work.
 - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, 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. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
 - 1. Description of the Work, including Specification Section number and paragraph, and Drawing sheet number and detail, where applicable.
 - 2. List of detrimental conditions, including substrates.
 - 3. List of unacceptable installation tolerances.
 - 4. Recommended corrections.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect in accordance with requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks and existing conditions. If discrepancies are discovered, notify Architect and Construction Manager promptly.
- B. Engage a land surveyor experienced in laying out the Work, using the following 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 and Construction Manager 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 lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out 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. Identification: Owner will identify existing benchmarks, control points, and property corners.
- B. 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.
 - 1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
 - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. 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.
 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- D. 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.
- E. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
 2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

- A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
1. Make vertical work plumb, and make horizontal work level.
 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
 4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces, unless otherwise indicated on Drawings.
- 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 satisfactory results as judged by Architect. 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 of type expected for Project.
- 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: Select tools or equipment that minimize production of excessive 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 portions of the 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 with manufacturer.
 - 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, as judged by Architect. Fit exposed connections together to form hairline joints.
- J. Repair or remove and replace damaged, defective, or nonconforming Work.
 - 1. Comply with Section 017700 "Closeout Procedures" for repairing or removing and replacing defective Work.

3.6 CUTTING AND PATCHING

- A. 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: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements in Section 011000 "Summary."
- 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 minimize 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 and Masonry: 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, as judged by Architect. 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 eliminate evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 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.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.
 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 COORDINATION OF OWNER'S PORTION OF THE WORK
- A. Site Access: Provide access to Project site for Owner's construction personnel
 - B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel
 1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
 2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend

preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.8 PROGRESS CLEANING

- A. 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.
 - a. Use containers intended for holding waste materials of type to be stored.
 - 4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
- 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: 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. Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls." Section 017419 "Construction Waste Management and Disposal."
- 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 ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.9 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."

3.10 PROTECTION AND REPAIR 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. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.
- C. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.
- D. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 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. .
 - 2. Section 311000 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.3 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.

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition and construction 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.

1.5 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 7 days of date established for the Notice to Proceed.

1.6 INFORMATIONAL SUBMITTALS

- A. 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.
- B. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- C. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- D. 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.
- E. 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.
- F. Qualification Data: For waste management coordinator.

1.7 QUALITY ASSURANCE

- A. Waste Management Conference(s): Conduct conference(s) at Project site to comply with requirements in Section 013100 "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.

1.8 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. 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. Use Form CWM-1 for construction waste and Form CWM-2 for demolition waste. 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. Use Form CWM-3 for construction waste and Form CWM-4 for demolition waste. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
 - 1. .

- D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there were no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Use Form CWM-5 for construction waste[and Form CWM-6 for demolition waste . Include the following:
1. Total quantity of waste.
 2. Estimated cost of disposal (cost per unit). Include transportation and tipping fees and cost of collection containers and handling for each type of waste.
 3. Total cost of disposal (with no waste management).
 4. Revenue from salvaged materials.
 5. Revenue from recycled materials.
 6. Savings in transportation and tipping fees by donating materials.
 7. Savings in transportation and tipping fees that are avoided.
 8. Handling and transportation costs. Include cost of collection containers for each type of waste.
 9. Net additional cost or net savings from waste management plan.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Achieve end-of-Project rates for salvage/recycling of 75 percent by weight of total nonhazardous solid waste generated by the Work. 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, including the following:
1. Demolition Waste:
 - a. Asphalt paving.
 - b. Concrete.
 - c. Concrete reinforcing steel.
 - d. Brick.
 - e. Concrete masonry units.
 - f. Wood studs.
 - g. Wood joists.
 - h. Plywood and oriented strand board.
 - i. Wood paneling.
 - j. Wood trim.
 - k. Structural and miscellaneous steel.
 - l. Rough hardware.
 - m. Roofing.
 - n. Insulation.
 - o. Doors and frames.
 - p. Door hardware.
 - q. Windows.
 - r. Glazing.
 - s. Metal studs.
 - t. Gypsum board.
 - u. Acoustical tile and panels.
 - v. Carpet.
 - w. Carpet pad.
 - x. Demountable partitions.

- y. Equipment.
- z. Cabinets.
- aa. Plumbing fixtures.
- bb. Piping.
- cc. Supports and hangers.
- dd. Valves.
- ee. Sprinklers.
- ff. Mechanical equipment.
- gg. Refrigerants.
- hh. Electrical conduit.
- ii. Copper wiring.
- jj. Lighting fixtures.
- kk. Lamps.
- ll. Ballasts.
- mm. Electrical devices.
- nn. Switchgear and panelboards.
- oo. Transformers.
- 2. Construction Waste:
 - a. Masonry and CMU.
 - b. Lumber.
 - c. Wood sheet materials.
 - d. Wood trim.
 - e. Metals.
 - f. Roofing.
 - g. Insulation.
 - h. Carpet and pad.
 - i. Gypsum board.
 - j. Piping.
 - k. Electrical conduit.
 - l. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
 - 1) Paper.
 - 2) Cardboard.
 - 3) Boxes.
 - 4) Plastic sheet and film.
 - 5) Polystyrene packaging.
 - 6) Wood crates.
 - 7) Wood pallets.
 - 8) Plastic pails.
 - m. Construction Office Waste: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following construction office waste materials:
 - 1) Paper.
 - 2) Aluminum cans.
 - 3) Glass containers.

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.
 - 1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."
- B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
 - 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.
- C. 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 and recycled.
 - 2. Comply with Section 015000 "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 024119 "Selective Demolition"] for salvaging demolition waste.

3.3 RECYCLING DEMOLITION WASTE

- A. Asphalt Paving: Grind asphalt to maximum 1-1/2-inch size.
 - 1. Crush asphaltic concrete paving and screen to comply with requirements in Section 312000 "Earth Moving" for use as general fill.
- B. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.
- C. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
 - 1. Pulverize concrete to maximum 1-1/2-inch size.
 - 2. Crush concrete and screen to comply with requirements in Section 312000 "Earth Moving" for use as satisfactory soil for fill or subbase.

3.4 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.

3.5 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. General: Except for items or materials to be salvaged or recycled, remove waste materials and legally dispose of at designated spoil areas on Owner's property.
- C. Burning: Do not burn waste materials.
- D. Burning: Burning of waste materials is permitted only at designated areas on Owner's property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.

END OF SECTION 017419

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 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.
- B. Related Requirements:
 - 1. Section 012900 "Payment Procedures" for requirements for Applications for Payment for Substantial Completion and Final Completion.
 - 2. Section 013233 "Photographic Documentation" for submitting Final Completion construction photographic documentation.
 - 3. Section 017823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
 - 4. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
 - 5. Section 017900 "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.3 DEFINITIONS

- A. List of Incomplete Items: Contractor-prepared list of items to be completed or corrected, prepared for the Architect's use prior to Architect's inspection, to determine if the Work is substantially complete.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of cleaning agent.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.5 CLOSEOUT SUBMITTALS

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

1.6 MAINTENANCE MATERIAL SUBMITTALS

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

1.7 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor'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, 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.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Owner's signature for receipt of submittals.
 - 5. Submit testing, adjusting, and balancing records.
 - 6. Submit sustainable design submittals not previously submitted.
 - 7. 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 utility services.
 - 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.
 - 10. Touch up paint 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 and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. 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.

1.8 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:
1. Submit a final Application for Payment in accordance with 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.
 5. Submit Final Completion photographic documentation.
- B. Inspection: Submit a written request for final inspection to determine acceptance 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 Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.9 LIST OF INCOMPLETE ITEMS

- 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 Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order, starting with exterior areas first listed by room or space number.
 2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Page number.
 4. Submit list of incomplete items in the following format:

- a. MS Excel Electronic File: Architect will return annotated file.
- b. PDF Electronic File: Architect will return annotated file.
- c. Three Paper Copies: Architect will return two copies.

1.10 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- D. Warranties in Paper Form:
 - 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 Contractor.
- E. 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.
 - 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

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 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 not planted, mulched, or paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Clean flooring, removing debris, dirt, and staining; clean according to manufacturer's recommendations.
 - i. Vacuum and mop concrete.
 - j. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - k. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - l. Remove labels that are not permanent.
 - m. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - p. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - 1) Clean HVAC system in compliance with NADCA ACR. Provide written report on completion of cleaning.
 - q. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
 - r. Clean strainers.
 - s. 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.
 - D. Construction Waste Disposal: Comply with waste-disposal requirements in Section 017419 "Construction Waste Management and Disposal."
- 3.2 REPAIR OF THE WORK
- A. Complete repair and restoration operations required by Section 017300 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory manuals.
 - 2. Emergency manuals.
 - 3. Systems and equipment operation manuals.
 - 4. Systems and equipment maintenance manuals.
 - 5. Product maintenance manuals.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.3 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.

1.4 CLOSEOUT SUBMITTALS

- A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved 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 operation and maintenance submittals is acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operation and maintenance manuals in the following format:
 - 1. Submit on digital media acceptable to Architect by email to Architect. Enable reviewer comments on draft submittals.
 - 2. Submit [three] paper copies. Architect, through Construction Manager, will return two copies.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect and Commissioning Authority will comment on whether general scope and content of manual are acceptable.
- D. Final 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 and Commissioning Authority will return copy with comments.

1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.
- E. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.
- 1.5 **FORMAT OF OPERATION AND MAINTENANCE MANUALS**
- A. **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:** Bookmark 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.
- B. **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. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
 - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, 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. Enclose title pages and directories in clear plastic sleeves.
 4. **Supplementary Text:** Prepared on 8-1/2-by-11-inch white bond paper.
 5. **Drawings:** Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

1.6 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 - 1. Title page.
 - 2. Table of contents.
 - 3. Manual contents.
- B. Title Page: 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 Construction Manager.
 - 7. Name and contact information for Architect.
 - 8. Name and contact information for Commissioning Authority.
 - 9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 - 10. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
 - 1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.7 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:
 - 1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
 - 2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
 - 3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

1.8 EMERGENCY MANUALS

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

1.9 SYSTEMS AND EQUIPMENT OPERATION MANUALS

- A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
 - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- B. 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 has 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.

C. 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.

D. 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.

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

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

1.10 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. 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 warranties and bonds as described below.

C. 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 and drawing or schedule designation or identifier where applicable.

- D. **Manufacturers' Maintenance Documentation:** Include the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins; 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.
 - a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
 - 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.
- E. **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.
- F. **Maintenance and Service Schedules:** Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
 - 1. **Scheduled Maintenance and Service:** Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 - 2. **Maintenance and Service Record:** Include manufacturers' forms for recording maintenance.
- G. **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.
- H. **Maintenance Service Contracts:** Include copies of maintenance agreements with name and telephone number of service agent.
- I. **Warranties and Bonds:** Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.
- J. **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 maintenance manuals.

1.11 PRODUCT MAINTENANCE MANUALS

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. 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.
- C. 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 and drawing or schedule designation or identifier where applicable.
- D. 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.
- E. 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.
- F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 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.
 - 4. Miscellaneous record submittals.
- B. Related Requirements:
 - 1. Section 017300 "Execution" for final property survey.
 - 2. Section 017700 "Closeout Procedures" for general closeout procedures.
 - 3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit copies of Record Drawings as follows:
 - a. Initial Submittal:
 - 1) Submit Record Digital Data Files and [one] <Insert number> set(s) of plots.
 - 2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal:
 - 1) Submit Record Digital Data Files and three set(s) of Record Digital Data File plots.
 - 2) Plot each drawing file, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit annotated PDF electronic files and one paper copy of Project's Specifications, including addenda and Contract modifications.
- C. Record Product Data: Submit [annotated PDF electronic files and directories and [paper copies] of each submittal.
 - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
- D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories and one paper copy of each submittal.

1.4 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.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding photographic documentation.
 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Construction Work Change Directive.
 - k. Details not on the original Contract Drawings.
 - l. Field records for variable and concealed conditions.
 - m. Record information on the Work that is shown only schematically.
 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 4. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect and Construction Manager. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Same digital data software program, version, and operating system as for the original Contract Drawings.
 2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 3. Refer instances of uncertainty to Architect through Construction Manager for resolution.
 4. Architect will furnish Contractor with one set of digital data files of the Contract Drawings for use in recording information.
 - a. See Section 013100 "Project Management and Coordination" for requirements related to use of Architect's digital data files.
 - b. Architect will provide data file layer information. Record markups in separate layers.

- C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
 - 1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 - 2. Format: Annotated PDF electronic file with comment function enabled.
 - 3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
 - 4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect and Construction Manager.
 - e. Name of Contractor.

1.5 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. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
 - 3. Note related Change Orders, Record Product Data, and Record Drawings where applicable.
- B. Format: Submit record specifications as annotated PDF electronic file

1.6 RECORD PRODUCT DATA

- 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. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 - 3. Note related Change Orders and Record Drawings where applicable.
- C. Format: Submit Record Product Data as annotated PDF electronic file].
 - 1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

1.7 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as PDF electronic file.

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

1.8 MAINTENANCE OF RECORD DOCUMENTS

- A. Maintenance of Record Documents: Store Record Documents 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 and Construction Manager's reference during normal working hours.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017839

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Instruction in operation and maintenance of systems, subsystems, and equipment.
 - 2. Demonstration and training video recordings.
- B. Unit Price for Instruction Time: Length of instruction time will be measured by actual time spent performing demonstration and training in required location. No payment will be made for time spent assembling educational materials, setting up, or cleaning up.

1.3 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.
- B. Qualification Data: For facilitator.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
 - 1. Identification: On each copy, provide an applied label with the following information:
 - a. Name of Project.
 - b. Name and address of videographer.
 - c. Name of Architect.
 - d. Name of Construction Manager.
 - e. Name of Contractor.
 - f. Date of video recording.
 - 2. Transcript: Prepared and bound in format matching operation and maintenance manuals. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding video recording. Include name of Project and date of video recording on each page.
 - 3. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to

corresponding training components. Include name of Project and date of video recording on each page.

4. At completion of training, submit complete training manual(s) for Owner's use prepared in same PDF file format required for operation and maintenance manuals specified in Section 017823 "Operation and Maintenance Data."

1.5 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. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.
- D. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
 1. Inspect and discuss locations and other facilities required for instruction.
 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
 3. Review required content of instruction.
 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.6 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 instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.7 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. Systems and equipment operation manuals.
 - c. Systems and equipment maintenance manuals.
 - d. Product maintenance manuals.
 - e. Project Record Documents.
 - f. Identification systems.
 - g. Warranties and bonds.
 - h. 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.

1.8 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."
- B. Set up instructional equipment at instruction location.

1.9 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. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
 - 2. Owner will furnish an instructor to describe Owner's operational philosophy.
 - 3. 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.
- F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

1.10 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
 - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.

- B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full HD mode.
1. Submit video recordings on CD-ROM or thumb drive.
 2. File Hierarchy: Organize folder structure and file locations according to Project Manual table of contents. Provide complete screen-based menu.
 3. File Names: Utilize file names based on name of equipment generally described in video segment, as identified in Project specifications.
 4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the equipment demonstration and training recording that describes the following for each Contractor involved on the Project, arranged according to Project Manual table of contents:
 - a. Name of Contractor/Installer.
 - b. Business address.
 - c. Business phone number.
 - d. Point of contact.
 - e. Email address.
- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
1. Film training session(s) in segments not to exceed 15 minutes.
 - a. Produce segments to present a single significant piece of equipment per segment.
 - b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
 - c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.
- D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
1. Furnish additional portable lighting as required.
- E. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.
- F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.
- G. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION 017900

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Demolition and removal of selected site elements.

1.2 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner
- C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.3 PREINSTALLATION MEETINGS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Predemolition Photographs or Video: Submit before Work begins.

1.5 CLOSEOUT SUBMITTALS

- A. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.6 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. Hazardous materials will be removed by Owner before start of the Work.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

1.7 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- D. 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 selective building demolition operations.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
 - 1. Comply with requirements for existing services/systems interruptions specified in Section 011000 "Summary."

3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Comply with requirements for access and protection specified in Section 015000 "Temporary Facilities and Controls."
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
- C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 - 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
 - 4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 - 5. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal."
- B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be **recycled,** reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
 - 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.
 - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 - 4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.6 CLEANING

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

END OF SECTION 024119

SECTION 032000 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Reinforcing steel bars, wire fabric and accessories for cast-in-place concrete.

1.2 REFERENCES

- A. California Building Code (CBC) 2019, as adopted by Authority Having Jurisdiction (AHJ).
- B. ACI 318 - Building Code Requirements For Structural Concrete.
- C. ACI SP-66 - American Concrete Institute-Detailing Manual.
- D. ASTM A82 - Steel Wire, Plain, for Concrete Reinforcement.
- E. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
- F. ASTM A706 - Low Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
- G. CRSI - Concrete Reinforcing Steel Institute Manual of Practice.
- H. CRSI - Placing Reinforcing Bars (5th ed.)
- I. AWS D1.4 Structural Welding Code - Reinforcing Steel.

1.3 SUBMITTALS

- A. Submit under provisions of Section 013300.
- B. Test Reports: Submit certified copies of mill test report of reinforcing steel analysis to testing laboratory, indicating products meet or exceed specified requirements. Include grades, physical and chemical properties.
 - 1. Where welding of reinforcing steel is required, submit mill reports indicating the chemical composition and the carbon equivalent (C.E.).
- C. Submit steel reinforcement shop drawings in accordance with ACI 315 for reinforcing work which deviates from structural drawings and specifications.
- D. Shop Drawings
 - 1. Submit steel reinforcement shop drawings in accordance with ACI 315. include placing drawings, assembly diagrams, bending charts and slab plans. Show length and locations of splices, size and length of reinforcing steel, and stirrup spacing.
- E. Product Data
 - 1. Reinforcing steel couplers: Submit current ICC Evaluation Report, clearly indicating compliance with the minimum specified strength criteria.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with CRSI, ACI 315, ACI 318 and applicable Sections of Chapter 19A, Part 2, Title 24, CCR.

1.5 QUALIFICATIONS

- A. Manufacturer

1. Manufacturer shall have produced the specified products for a period of five (5) years prior to beginning work of this section, and shall have the capability to produce the specified products to the delivery and quantity criteria of the project.
 2. Unless noted otherwise, reinforcing steel may be of domestic or imported origin, subject to compliance with specified criteria.
- B. Fabricator/Erector
1. For fabrication and installation of work, use only personnel who are thoroughly trained and experienced in the skills required, have installed similar applications of the specified products within one year prior to beginning work on this section, and who are completely familiar with the requirements of this work.
 2. Fabricator shall be currently licensed and approved by jurisdictional authority as an approved fabricator of reinforcing steel.
- C. Detailer
1. For detailing of reinforcing steel shop drawings, use only personnel who are thoroughly trained and experienced in the skills required.
 2. Detailer, or lead detailer when more than one detailer is used, shall have a minimum of five (5) years experience in the detailing of similar structures.
 3. Submit qualifications of detailer, or lead detailer, to architect for review.
- 1.6 COORDINATION
- A. Coordinate work under provisions of Section 013100.
- B. Coordinate with placement of formwork, formed openings and other Work.
- 1.7 PRODUCT HANDLING
- A. Deliver reinforcement to the Project Site bundled, tagged and marked. Indicate on tags, bar size, lengths, and other information corresponding to markings shown on placement diagrams.
- B. Store materials at the Project Site to prevent damage and accumulation of dirt and excessive rust. Store welding electrodes in accord with AWS D1.4.

PART 2 - PRODUCTS

2.1 REINFORCEMENT

- A. Reinforcing Steel:
1. Non-Welded Systems: ASTM A 615, deformed billet steel bars, plain finish.
 - a. Bar size #4 and larger: Grade 60.
 - b. Bar size less than #4: Grade 60.
 - c. Grade 60, where shown.
 2. Welded Systems: ASTM A 706, Grade 60.
- B. Dowels: Same as 2.1.A.
- C. Reinforcing steel couplers: Provide mechanical couplers maintaining positive alignment and developing, in tension or compression as required, at least 125% of the specified yield strength of the bars, or of the smaller bar in transition splices.

2.2 ACCESSORY MATERIALS

- A. Tie Wire: Minimum 16 gage annealed type .

- B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor retarder/retarder/barrier puncture.
- C. Electrodes for welding ASTM A 706 reinforcing steel: Conform to requirements of Specifications for Low Alloy Steel Covered Arc-Welding Electrodes, AWS A5.5, E80XX Series, low hydrogen, having a minimum yield point of 80,000 psi.

2.3 FABRICATION

- A. Fabricate concrete reinforcing in accordance with CRSI Manual of Standard Practice, ACI 315, and ACI 318.
- B. Do NOT bend or straighten bars in manner that will weaken or injure bar. Do not re-bend bars #5 and larger.
- C. Do NOT use heat to bend bars.
- D. Remove and replace reinforcement with following fabrication defects.
 - 1. Bar lengths, depths and bends exceeding specified fabrication tolerances.
 - 2. Bends or kinks not shown on Drawings or final shop drawings.
 - 3. Bars with reduced cross-section due to excessive rusting or other cause
- E. Locate reinforcing splices as shown on Drawings. Obtain approval of Structural Engineer for splices not shown on drawings.

2.4 SOURCE QUALITY CONTROL AND TESTING

- A. Provide for testing under the provisions of Section 014529.
 - 1. Reinforcing Bars: Sections 1913A.2, Chapter 19A, Part 2, Title 24, CCR.
 - 2. Cost of testing for unidentified stock shall be reimbursed to the Owner by the Contractor.
- B. Provide mill test certificates indicating the following information:
 - 1. Steel Source and Description
 - 2. Ultimate tensile strength, Bend test, Elongation percentage and Yield point.
 - 3. Heat number and Chemical analysis.
- C. Sample and test reinforcing for compliance with ASTM A 615 and ASTM A 706.
 - 1. When materials are delivered with heat number and mill test, the Testing Laboratory shall make one series of tests (tensile and bend) for each 10.0 tons, or fraction, of each size and kind of reinforcing steel.
 - 2. Identified Structural Steel: Tests are waived for steel identified by heat number, accompanied by mill analyses and mill test reports and properly tagged with Identification Certificate so as to be readily identified for conformance with applicable ASTM standard
 - 3. When materials cannot be identified by documentation acceptable to Architect, the Testing Laboratory shall make one series of tests (tensile and bend) for each 2.5 tons, or fraction, of each size and kind of reinforcing steel.
 - a. Payment for such testing will be borne by Contractor.

2.5 OTHER MATERIALS

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

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Inspection
 - 1. Prior to work of this section, carefully inspect previously installed work. Verify all such work is complete to the point where this installation may properly commence.
 - 2. Verify that work of this section may be installed in strict accordance with the original design, all pertinent codes and regulations, and all pertinent portions of the referenced standards.
 - 3. In the event of discrepancy, immediately notify the Architect.
 - 4. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 PLACEMENT

- A. Place all concrete reinforcing in accordance with CRSI Placing Reinforcing Bars and ACI 318 Chapter 7.
- B. Before placing, clean reinforcing of loose scale, rust, oil, dirt, and any coating adversely affecting concrete bond.
- C. Place, support and secure reinforcement against displacement. Do not deviate from required position.
- D. Use metal chairs to hold reinforcement the proper distance above form bottoms. In beams and slab construction, use chairs under the top slab reinforcement as well as under the bottom reinforcement. Space chairs so that the reinforcement will not be displaced under a man's weight. Use metal spacers to secure proper spacing. Stirrups shall be accurately and securely wired to the bars at both top and bottom. At slabs, footings, and beams in contact with earth, use concrete blocks to hold reinforcement proper distance above the earth.
- E. Place and secure reinforcement so as to maintain the proper clearance between parallel bars, and between bars and the forms. Lapped splices shall be made wherever possible in a manner to provide proper clearance between sets of bars. Lapped splices shall, in general, be staggered. Dowels and bars extending through construction joints shall be secured in position against displacement before concrete is placed, and shall be cleaned of concrete adhering immediately after completion of the pour while the incrustations are still soft.
- F. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets 1 1/2 spaces and 12 inch minimum. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
- G. Do not place reinforcing in supported slabs and beams until the walls and columns have been poured to the underside of the slabs and beams, nor until construction joints have been thoroughly cleaned.
- H. Do not displace or damage vapor retarder/retarder/barrier.
- I. Accommodate placement of formed openings.
- J. Maintain concrete cover around reinforcing as indicated.
- K. Do NOT bend or straighten bars after placement.

- L. Interrupt reinforcement at control, contraction, and expansion joints or as indicated on drawings.
 - M. Place reinforcement to achieve slab and curb alignment as detailed.
 - N. Provide dowel joints at interruptions of concrete.
 - O. Welded splices: Comply with the requirements of AWS D1.4 and structural drawings.
 - 1. Use only welders who have passed the AWS standard qualification tests within the previous year.
 - 2. Weld splices to develop 125% of the specified yield strength of the bars, or of smaller bar in transition splices.
 - 3. Clean bars of oil, grease, dirt and other foreign substance and flame-dry before welding.
 - 4. Preheat bars as required by AWS D1.4 before welding. Stagger splices in adjacent bars.
 - 5. Prepare ends of bars in compliance with AWS D1.4.
 - P. Mechanical coupling devices: Comply with ICC Evaluation Report and manufacturer's direction for bar preparation and installation.
 - Q. Welding: Comply with the requirements of AWS D1.4 for field welding. Prior to field welding, determine the weldability of reinforcing bars by a laboratory chemical analysis of steel, except for ASTM A706 bars. Only steel conforming to the chemical requirements specified in AWS D1.4 may be welded.
 - R. Comply with Section 1705A.2.2.1.2, Chapter 17A, Part 2, Title 24, CCR, and AWS D1.4 at all welding of reinforcing bars.
- 3.3 FIELD QUALITY CONTROL
- A. Field inspection will be performed under provisions of Section 014500 and 014529.
 - B. Notify Architect 48 hours minimum prior to placement of concrete.
 - C. Inspections and tests of welds as required by AWS D1.4 will be made by the Testing Laboratory for reinforcing bar welds, including:
 - 1. Certification of welders engaged in welding of reinforcing.
 - 2. Inspection of reinforcing bar welds.
 - 3. Perform 2 tensile tests of sample welds of the largest size bar for each type of welding.
 - D. Deficient welds will require the Contractor to provide and pay for such additional tests and inspections as required. Repair or replace defective welds as acceptable.

END OF SECTION 032000

SECTION 033000 - 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. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Footings.
 - 2. Foundation walls.
 - 3. Slabs-on-grade.
 - 4. Suspended slabs.
 - 5. Concrete toppings.
 - 6. Building frame members.
 - 7. Building walls.
 - 8. Grout.

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.

1.4 ACTION 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.
- C. Samples: For vapor retarder.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer manufacturer testing agency.
- B. Welding certificates.
- C. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Form materials and form-release agents.
 - 3. Bonding agents.
 - 4. Adhesives.
 - 5. Joint-filler strips.
 - 6. Repair materials.
- D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
 - E. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
- 1.6 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.
 - 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. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
 - D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."
 - E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
 - F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- 1.7 PRE CONSTRUCTION CONFERENCE:
- A. A pre-construction meeting shall take place to insure that all parties involved in construction understand the importance of the finished floor requirements.
 - B. During this meeting it will be required that the following individuals are in attendance, including;
 1. General contractor
 2. Concrete sub contractor
 3. Ready mix producer
 4. Pumping company
 5. Color manufacturer (if required)
 6. Polishing contractor
 7. Architect or owners representative
 8. Testing laboratory (if required)
 9. Screed operator (if required)
 - C. Topics for discussion may include;
 1. Design mixture
 2. Placement schedule
 3. Placement methods
 4. Tolerances (F-numbers)

5. Curing method
6. Jointing
7. Slab protection / responsibility
8. Vapor barrier / type and installation
9. Finishing practices / final required finish
10. Mock-up approvals
11. Site walk through
12. Safety

1.8 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 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. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Forms for Cylindrical Columns, Pedestals, and Supports:
 1. Concrete Column Forms: Sonotube Finish Free concrete forms with Duraglas coating.
 2. Interior Surface: Duraglas coating. Smooth with no spiral seams or form markings.
 3. Exterior Surface: Micryl moisture barrier coating.
 4. 1-piece, 1-time-use forms.
 5. Inside Diameter: As indicated on the Drawings
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- D. 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.
- E. 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 dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT

1. General: Comply with Section 032000 "Concrete Reinforcing" for steel reinforcement and other requirements for reinforcing accessories.

2.3 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 1. Portland Cement: ASTM C 150, Type V, gray, unless noted otherwise on plans.
 - a. Fly Ash: ASTM C 618, Class F.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- B. Silica Fume: ASTM C 1240, amorphous silica.
- C. Normal-Weight Aggregates: ASTM C 33, Class 3S for foundations, Class 5S for slabs, columns and walls 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:
 - a. Slabs, columns, walls: 1 inch nominal.
 - b. Foundations: 1 1/2 inch nominal.
 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Water: ASTM C1602 and potable.

2.4 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride. Admixtures shall be subject to prior approval by DSA.
 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- C. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
- D. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:
 - a. Scofield, L. M. Company.
 2. Color: As selected by Architect from manufacturer's full range.

2.5 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.
 - 1. Products: Subject to compliance with requirements, provide the following or equal:
 - a. Stego Industries, LLC; Stego Wrap 15 mil Class A.
 - b. WR Meadows, Perminator 15 mil Class A.
 - c. Reef Industries, Griffolyn 15 mil Class A.
 - 2. Permeance: Maintain permeance of less than 0.0086 Perms as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).
 - 3. Perimeter Edge Seal: Stego Crete Claw by Stego Industries LLC or equal.
- B. Vapor barrier shall have all the following qualities:
 - 1. Maintain permeance of less than 0.01 Perms [grains/(ft² · hr · inHg)] as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).
 - 2. Other performance criteria:
 - a. Strength: ASTM E1745 Class A.
 - b. Thickness: 15 mils minimum
 - 3. Provide third party documentation that all testing was performed on a single production roll per ASTM E1745 Section 8.1
 - 4. Warranty: (a) compliance with the designated ASTM E1745 classification, and (b) no manufacturing defects in the product for, at least, the Life of the Building.
- C. ACCESSORIES
 - 1. Seams:
 - a. Stego Tape by Stego Industries LLC, (877) 464-7834 or equal.
 - 2. Sealing Penetrations of Vapor barrier:
 - a. Stego Mastic by Stego Industries LLC, (877) 464-7834 or equal.
 - b. Stego Tape by Stego Industries LLC, (877) 464-7834 or equal.
 - 3. Perimeter/terminated edge seal:
 - a. Stego Crete Claw (textured tape) by Stego Industries LLC, (877) 464-7834 or equal.
 - b. Stego Term Bar by Stego Industries LLC, (877) 464-7834 or equal.
 - c. StegoTack Tape (double-sided sealant tape) by Stego Industries LLC, (877) 464-7834 or equal.
 - d. One-sided seaming tape is not a recommended method of sealing at the terminated edge.
 - 4. Penetration Prevention:
 - a. Beast Foot by Stego Industries LLC, (877) 464-7834 or equal.
 - 5. Vapor Barrier-Safe Hand Screed System
 - a. Beast Screed by Stego Industries, LLC, (877) 464-7834 or equal.
- D. Granular Fill: Per structural drawings.

2.6 LIQUID FLOOR TREATMENTS

- A. VOC Content: Liquid floor treatments shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Penetrating Liquid Floor Treatment (CS-1): Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

1. Products: Subject to compliance with requirements, provide the following or equal:
 - a. Curecrete Distribution Inc.; Ashford Formula.

- C. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for polished concrete surfaces.

2.7 CURING MATERIALS

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

2.8 RELATED MATERIALS

- A. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- B. Reglets: Fabricate reglets of not less than 0.022-inch- thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

2.9 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Admixtures: Use admixtures according to manufacturer's written instructions.
 1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 3. Use water-reducing admixture in pumped concrete, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
- C. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.10 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings: Proportion normal-weight concrete mixture as follows:
 1. Minimum Compressive Strength: As indicated on drawings at 28 days.
 2. Maximum Water-Cementitious Materials Ratio: As indicated on drawings.
 3. Slump Limit: As indicated on drawings..
- B. Foundation Walls: Proportion normal-weight concrete mixture as follows:
 1. Minimum Compressive Strength: As indicated on drawings.
 2. Maximum Water-Cementitious Materials Ratio: As indicated on drawings
- C. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
 1. Minimum Compressive Strength: As indicated on drawings.
 2. Minimum Cementitious Materials Content: As indicated on drawings.
 3. Slump Limit: As indicated on drawings.
- D. Building Walls: Proportion normal-weight concrete mixture as follows:
 1. Minimum Compressive Strength: As indicated on drawings.

2. Maximum Water-Cementitious Materials Ratio: As indicated on drawings.
3. Slump Limit: As indicated on drawings.

2.11 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

2.12 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

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 347 as abrupt or gradual, as follows:
 1. Class B, 1/4 inch for rough-formed 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.
- 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.

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."
 - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 - 3. Install dovetail anchor slots in concrete structures as indicated.

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. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be 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 70 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 SHORES AND RESHORES

- A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.

3.5 VAPOR RETARDERS

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches and seal with manufacturer's recommended tape.
 - 2. Extend vapor retarder to the perimeter of the slab. If practicable, terminate it at the top of the slab or where obstructed by impediments, such as dowels, waterstops, or any other site condition requiring early termination of the vapor barrier. At the point of termination, seal vapor barrier to the foundation wall, grade beam or slab itself.

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. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 - 3. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 - 4. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 - 5. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 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. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. 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.
- E. 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.
- F. 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.
- G. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. 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.
 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.8 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.

3.9 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
1. Apply scratch finish to surfaces indicated to receive concrete floor toppings to receive mortar setting beds for bonded cementitious floor finishes.
- C. 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 to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraigten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 - 2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
 - a. Carpeted slabs Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.
 - b. Floor Coverings Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
 - c. Polished Concrete Specified overall values of flatness, F(F) 45; and of levelness, F(L) 35; with minimum local values of flatness, F(F) 30; and of levelness, F(L) 24.
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
 - 1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

3.10 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. 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.
- D. Miscellaneous Site Concrete Components: Provide light water or sandblast finish at the vertical surfaces of all planters, benches, and related site furnishings, sufficient to remove surface paste and expose fine aggregate. Provide smooth steel trowel at flat seating surfaces.
- E. Exterior Slab Floors at service areas: Exterior Service/Utility Concrete Slabs: Provide steel trowel and medium broom finish. Broom finish shall be placed in a pattern as directed by the Architect.
- F. Wall/column/footing face Finish:
 - 1. Sandblasted Concrete:
 - a. Produce surface without honeycomb, air pockets or "bug holes".
 - b. Utilize high density form with joints butt taped or with non absorbent sealant.
 - c. Remove Supertie and finish as recommended by manufacturer.

- d. Water or sandblast exposed surface by approved means in medium texture, exposing coarse aggregate to a depth of 1/16 inch.
- 2. Exposed Aggregate Concrete:
 - a. Water or sandblast exposed surface by approved means in medium texture, exposing coarse aggregate to a depth of 1/8 inch.

3.11 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 301 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:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. 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.
 - c. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive polished concrete finish.
 - d. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
 - 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. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

4. Protection at Polished Concrete: After concrete is cured and prior to polishing, protect all areas to receive polished concrete with Skudo HT floor protection. Vapor transmission rate and pH level testing shall be in conformance with installation requirements prior to installation.

3.12 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
 1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 2. Do not apply to concrete that is less than 28 days' old.
 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.
- B. Polished Concrete Floor Treatment: Apply polished concrete finish system per 033510.

3.13 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 1. Defer joint filling until concrete has aged at least six month(s). 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 semirigid 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 to solid concrete. Limit cut depth to 3/4 inch. 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, popouts, 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. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. 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.
 7. 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 qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
1. Reinforcing steel placement.
 2. Reinforcing steel welding.
 3. Headed bolts and studs.
 4. Verification of use of required design mixture.
 5. Concrete placement, including conveying and depositing.
 6. Curing procedures and maintenance of curing temperature.

7. Verification of concrete strength before removal of shores and forms from beams and slabs.
- 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: Samples for strength tests of each class concrete placed each day shall be taken not less than once a day, or not less than once for each 50 cubic yards of concrete, or not less than once for each 2,000 square feet of surface area for slabs or walls. Additional samples for seven-day compressive strength tests shall be taken for each class of concrete at the beginning of the concrete work or whenever the mix or aggregate is changed.
 - 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. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. 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.
 10. Test results shall be reported in writing to Architect, concrete manufacturer, 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.
 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.
- D. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.
- 3.16 PROTECTION OF LIQUID FLOOR TREATMENTS
- A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
- 3.17 VAPOR RETARDER INSTALATION
- A.
- B. Contact vapor barrier manufacturer to schedule a pre-construction meeting and to coordinate a review, in-person or digital, of the vapor barrier installation.
- C. Install vapor barrier in accordance ASTM E1643.
1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.
 2. Extend vapor barrier to the perimeter of the slab. If practicable, terminate it at the top of the slab, otherwise (a) at a point acceptable to the architect or (b) where obstructed by impediments, such as dowels, water stops, or any other site condition requiring early termination of the vapor barrier. At the point of termination, seal vapor barrier to the foundation wall, grade beam or slab itself.
 - a. Seal vapor barrier to the entire slab perimeter using manufacturer's textured tape with a surface that creates a mechanical seal to freshly-placed concrete, per manufacturer's instructions.
 - b. Seal vapor barrier to the entire perimeter wall or footing/grade beam with manufacturer's double-sided tape, or both termination bar and double-sided tape, per manufacturer's instructions. Ensure the concrete is clean and dry prior to adhering tape.
 3. Overlap joints 6 inches and seal with manufacturer's seam tape.
 4. Apply seam tape/textured tape/double-sided tape to a clean and dry vapor barrier.
 5. Seal all penetrations (including pipes) per manufacturer's instructions.
 6. Avoid the use of stakes driven through vapor barrier by utilizing screed and forming systems that will not leave punctures in the vapor barrier.
 7. Repair damaged areas with vapor barrier material of similar (or better) permeance, puncture and tensile.

END OF SECTION 033000

SECTION 033510 - POLISHED CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. This Section includes polished concrete finish in accordance with concept for interior concrete flatwork
 - 2. Applying densifying impregnator/sealer and polishing to specified sheen level and aggregate exposure.

1.3 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. ACI302.1R-89, Guide for Concrete Floor and Slab Construction.
- B. American Society for Testing and Materials:
 - 1. ASTM C779, Standard Test Method for Abrasion of Horizontal Concrete Surfaces.
 - 2. ASTM C805, Impact Strength.
 - 3. ASTM G23-81, Ultraviolet Light & Water Spray.
 - 4. ASTM 1028, Co-efficient of Friction.
 - 5. ASTM C 150, Type I, II Portland cement conformity, depending on soil conditions.
 - 6. ASTM C 33, Aggregate conformity.

1.4 SUBMITTALS

- A. Product data for each grinding machine, including all types of grinding heads, dust extraction system, joint filler, concrete densifying impregnator, penetrating sealer, and any other chemicals used in the process.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.3: For liquid floor treatments and curing and sealing compounds, documentation including printed statement of VOC content
- C. Applicators qualification data.
- D. Shop Drawings: Indicate information on shop drawings as follows:
 - 1. Typical layout including dimensions and floor grinding schedule
 - 2. Plan view of floor and joint pattern layout
 - 3. Areas to receive color or aggregate treatment
 - 4. Hardener, sealer and densifier information
- E. Product Data: Submit product data, including manufacturer's product sheet for specified products.
 - 1. Material Safety Data Sheets (MSDS).
 - 2. Preparation and concrete grinding procedures.
- F. Concrete cleaning and maintenance requirements.

1.5 WARRANTY

- A. Provide a two year warranty of the polishing system and products.

1.6 QUALITY ASSURANCE

A. Mock-ups:

1. Reserve 100 square feet for each color and finish at location as directed under conditions similar to those which will exist during actual placement.
 - a. Install mock-ups to verify selections made under sample submittal and to demonstrate methods and workmanship proposed for the project.
 - b. Slabs for slip resistant rating.
2. Aggregate selected must be tested to ensure it will accept polish.
3. The curing method and its affects shall be demonstrated on the physical mock-up panel before the slab construction begins so that approval can be made.
4. Allow 72 hours for inspection of mockup before proceeding with work.
5. When accepted, mock-up will demonstrate minimum standard of quality required for this work. Remove mock-up and dispose of materials when no longer required and when direct by Architect.

- B. Slip Resistance Testing: Test six representative 12 x 12 inch mock-ups per ASTM C1028 to verify compliance with slip resistance criteria. Slip resistance surface shall achieve a minimum co-efficient of friction of 0.60 for wet and dry tests.

- C. Manufacturer Qualifications: The ULTRAFLOR® DIAMATIC® Polished Concrete System consists of a process and products engineered and manufactured by DIAMATIC® Any substitutions are not permitted and void warranty.

D. Installer Qualifications:

1. Installer must be a DIAMATIC® CERTIFIED installer for the ULTRAFLOR® Polished Concrete System, including the use of DIAMATIC® equipment and diamond abrasives, and DIAMATIC concrete preparation, and chemical hardening and finishing materials.
2. Installer must be experienced in performing specified work similar in design, products and scope of this project, with a documented track record of successful projects. Provide at least 3 projects that are greater than 50,000 sq. ft. completed within the last 2 years each with contact info and project details. These documents must be provided with proposal at time of bid.
3. A factory-trained, competent supervisor must be maintained on site during all times during which specified work is performed.
4. National brand specific projects must have DMS (Diamatic Management Services) personnel present during the pre-construction conference to insure quality control standards are in compliance.
5. Equipment allowed will be both the Diamatic 780 and Terrco 6200.
6. Contractor must be an ARDEX LEVEL MASTER ELITE INSTALLER to provide warranty's on patching products and polish installation. A copy of LME certification must be presented with proposal at time of bid.

1.7 PRE CONSTRUCTION CONFERENCE:

- A. A pre-construction meeting shall take place to insure that all parties involved in construction understand the importance of the finished floor requirements.
- B. During this meeting it will be required that the following individuals are in attendance, including;

1. General contractor
 2. Concrete sub contractor
 3. Ready mix producer
 4. Pumping company
 5. Color manufacturer (if required)
 6. Polishing contractor
 7. Architect or owners representative
 8. Testing laboratory (if required)
 9. Screed operator (if required)
- C. Topics for discussion may include;
1. Design mixture
 2. Placement schedule
 3. Placement methods
 4. Tolerances (F-numbers)
 5. Curing method
 6. Jointing
 7. Slab protection / responsibility
 8. Vapor barrier / type and installation
 9. Finishing practices / final required finish
 10. Mock-up approvals
 11. Site walk through
 12. Safety

PART 2 - PRODUCTS

2.1 POLISHED CONCRETE FINISHING PRODUCTS

- A. Manufacturer: Diamatic, Inc or equal.
1. Hardener, Sealer, Densifier: Water based, odorless liquid, VOC compliant, environmentally safe chemical hardening solution leaving no surface film.
 - a. Acceptable Material: Diamatic FLOR-SIL .
 2. Joint Filler: Semi-rigid, 2-components, self leveling, 100% solids, rapid curing, polyurea control joint and crack filler with Shore A 65-67 or higher hardness.
 - a. Acceptable Material: High Tech Systems Joint Fill HT-PE75
 3. Concrete Dyes: Fast drying dye, packaged in premeasured units ready for mixing with VOC compliant solvent, formulated for application to polished cementitious surfaces.
 - a. Acceptable Material: Diamatic FLOR-COLOR
 - b. Color: As selected by architect.
 4. Floor Finish: Mild, highlt concentrated liquid concrete cleaner and conditioner containing wetting and emulsifying agents; biodegradable, environmentally safe and certified High Traction by National Floor Safety Institute (NFSI)
 - a. Acceptable Material: Diamatic FLOR-FINISH.
 5. Final Finish: Dyed 800 grit.
 6. Colors:
 - a. Polished Concrete Color One (PC-1): Natural grey cement.
 - b. Polished Concrete Color Two (PC-2): Concrete Dye 50% dilution, one coat, Standard Color Palette, medium shade.
 - c. Polished Concrete Color Three (PC-3): Concrete Dye 50% dilution, two coats, Standard Color Palette, dark shade.
 - d. Polished Concrete Color Four (PC-4): Natural grey cement with seeded aggregate.

2.2 FLOOR POLISH AND CONDITIONER

- A. Manufacturer: Ecolab, St. Paul, Minnesota, (651)293-2233, <http://ecolab.com>
 - 1. Anit-slip polish and conditioner protection designed for concrete surfaces per UL-193S.
 - a. Acceptable Material: Stone-Medic Friction Stone
 - b. Provide four (4) gallons of material to Owner.

2.3 SOURCE QUALITY CONTROL

- A. Ensure concrete finishing components and materials are from a single manufacturer

PART 3 - EXECUTION

3.1 MANUFACTUERS INSTRUCTIONS

- A. Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalog instructions, product carton installation instructions and SPEC-DATA sheets.

3.2 EXAMINATION

- A. Site Verification of Conditions:
 - 1. Verify that the concrete substrate conditions, which have been previously installed under other sections or contracts, are acceptable for product installation in accordance with manufacturer's instructions prior to installation of concrete finishing materials.
- B. Verify Concrete Slab Performance Requirements:
 - 1. Verify concrete is cured to 14-21 days.
 - 2. Verify concrete surfaces received a hard teal-trowel finish during placement.

3.3 PREPARATION

- A. Ensure surfaces are clean and free of dirt and other foreign matter harmful to the performance of concrete finishing materials.
- B. Examine the surface to determine soundness of concrete for polishing.
- C. General Contractor to remove surface contamination.

3.4 POLISHED CONCRETE APPLICATION

- A. Level C Gloss - High gloss reading of 56 and higher.
 - 1. Clean out control joints and fill with PE65 High Tech Joint Fill color to be chosen by architect.
 - 2. GRIND/POLISH #1: DIAMATIC 30/40 Grit Metal Bonded Diamonds.
 - 3. Broom and vacuum the floor to remove all residual dust and patch floor with ARDEX SDM patching compound. Color to be mixed 3 parts grey 1 part white.
 - 4. GRIND/POLISH #2: DIAMATIC 60/80 Grit Metal Bonded Diamonds.
 - 5. Broom and vacuum the floor to remove all residual dust.
 - 6. GRIND/POLISH #3: 50 Grit Copper based Hybrid Resin.
 - 7. Broom and vacuum the floor to remove all residual dust.
 - 8. GRIND/POLISH #4: Diamatic 100 Grit Resin bonded Diamonds
 - 9. GRIND/POLISH #5: DIAMATIC 200 Grit Resin Bonded Diamonds.
 - 10. GRIND/POLISH #6: DIAMATIC 400 Grit Resin Bonded Diamonds.
 - 11. Power Scrub floor to clean and remove any residual dust

12. Apply DIAMATIC® FLOR-COLOR™ according to the technical data guidelines at the rate of 400-500 square feet per gallon. Allow to dry completely before continuing to the next step, (a minimum time of 1 hour) where required per plans.
 13. Apply DIAMATIC FLOR-SIL™ per application instructions at a rate of 400 square feet per gallon.
 14. GRIND/POLISH #7: DIAMATIC 800 Grit Resin Bonded Diamonds.
 15. Broom and vacuum the floor to remove all residual dust.
 16. Apply DIAMATIC FLOR-FINISH (High Gloss) per application instructions at a rate of 2,500-3,000 square feet per gallon.
 17. MICROPOLISH/BURNISH #1: FLOR-GRIT 1500 Diamond Impregnated Pad.
 18. Apply DIAMATIC FLOR-FINISH (High Gloss) per application instructions at a rate of 2,500-3,000 square feet per gallon.
 19. Allow to dry a minimum of 15-30 minutes.
 20. MICROPOLISH/BURNISH #2: FLOR-GRIT 3000 Diamond Impregnated Pad.
 21. Cover Floor with Ram Board.
- B. Floor Surface Polishing and Treatment:
1. Provide polished concrete floor treatment in entirety of slab indicated by drawings. Provide consistent finish in all contiguous areas.
 2. Apply floor finish prior to installation of fixtures and accessories.
 3. Diamond polish concrete floor surfaces with power disc machine as outlined above.
 4. Comply with manufacturer's recommended polishing grits for each sequence to achieve desired finish level. Level of shen shall match that of approved mockup.
 5. All concrete surfaces shall be as uniform in appearance as possible.
 6. Remove defects and repolish defective areas.
 7. Finish edges of floor finish adjoining other materials in a clean and sharp manner.
- C. ADJUSTMENTS
1. Polish to higher gloss those areas not meeting specified gloss level per mockup.
 2. Fill joints flush to surface.
- D. PROTECTION
1. Protect exposed concrete finish such as bases, curbs and similar work as necessary to prevent damage resulting from impact or from subsequent work.
 2. Protect finished work from damage with Ram Board.
 3. The covering shall be maintained until the contractor is able to install the ULTRAFLOR® Finish. After completion of the ULTRAFLOR® installation the area shall be protected in the same manner until the floor is turned over to the owner.
 4. Prior to and during the installation of the ULTRAFLOR® finish the floor must be kept free of debris or contaminants that may affect the finished surface. This will include any construction chemicals, adhesives, paints, or other materials that may cause damage to the surface.
 5. All other trades shall be kept off of the floor during the installation of the ULTRAFLOR® finish.
 6. Do not allow traffic of any kind on polished concrete slab for a minimum of one (1) day.
 7. Maintain protection in effective condition for as long as the need for protection exists.
 8. Apply polish and conditioner to all surfaces.

END OF SECTION 033510

SECTION 040513 MASONRY MORTAR AND GROUTING



PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Mortar and grout for masonry.

1.2 RELATED WORK

- A. Section 01 45 29 - Testing Laboratory Services.
- B. Section 04 22 00 - Reinforced Unit Masonry System.

1.3 REFERENCES

- A. California Building Code (CBC) 2019 edition, as adopted by Authority Having Jurisdiction (AHJ).
- B. ASTM C94 - Ready-Mixed Concrete
- C. ASTM C144 - Aggregate for Masonry Mortar.
- D. ASTM C150 - Portland Cement.
- E. ASTM C207 - Hydrated Lime for Masonry Purposes.
- F. ASTM C270 - Mortar for Unit Masonry.
- G. ASTM C404 - Aggregates for Masonry Grout.
- H. ASTM C476 - Grout for Masonry.
- I. ASTM C1019 - Sampling and Testing Grout.
- J. ASTM C1586 - Standard Guide for Quality Assurance of Mortars.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Section 01 60 00.
- B. Store and protect products under provisions of Section 01 60 00.
- C. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Product Data: Provide data on admixtures, including product characteristics, compatibility and limitations.

- C. Mix designs: Include the following information in grout and mix design data:
1. Design
 - a. Project name, address, site location, and location of mix design usage.
 - b. Contractor, Sub-Contractor, Supplier and Plant Location.
 - c. Mix Number.
 - d. Specified compressive strength, maximum aggregate size, slump, and placement method.
 - e. Application and location in structure.
 - f. Signature and stamp of licensed civil engineer responsible for mix design.
 2. Materials
 - a. Design Method.
 - b. Slump.
 - c. Cement: Type, amount, and compliance with specified criteria statement.
 - d. Aggregates: Source(s), gradations (individual and combined).
 - e. Admixtures: Brand, classification, dosage, addition method.
 - f. Water source.
 - g. Test Results, Batch Quantities, Yield (calculations).
 3. All other considerations relative to placement, curing, finishing and testing.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Maintain materials and surrounding air temperatures to minimum 50 degrees F prior to, during, and 48 hours after completion of masonry work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Mortar Aggregate: ASTM C144 with not less than 3 percent passing #100 sieve.
- B. Grout Aggregate: ASTM C404.
1. Coarse Aggregate: 100 percent passing 3/8 inch sieve and not more than 5 percent passing #8 sieve.
 2. Fine Aggregate: Washed, natural sand; not more than 2 percent by weight deleterious substances; 5 percent minimum passing # 100 sieve.
- C. Portland Cement: ASTM C150, Type I or II, free alkali content 0.06 percent maximum, gray color. Use Type II where soil contact will occur.
- D. Hydrated Lime: ASTM C207, Type S.
- E. Water: Clean and potable.
- F. Admixtures:
1. Grout Admixtures: Sika, Grout Aid .
 2. Mortar: No admixtures permitted, *except colorant*.
 - a. Mortar Colorant: Approved for use in mix, 100 percent mineral oxide, two separate colors as selected by Architect from standard color range. Provide mortar colorant at applications where masonry is exposed to view in final construction.

2.2 MORTAR MIXES

- A. Mortar for Reinforced Masonry: ASTM C270, Section 2103A.2.1, Chapter 21A, Part 2, Title 24, CCR.
- B. Provide Type S or M as indicated on Structural Drawings, minimum compressive strength as indicated on the drawings.
 - 1. Proportions - Type S:
 - a. 1 Part Portland Cement.
 - b. Not less than 1/4 part nor more than 1/2 part lime.
 - c. Mortar Aggregate: Not less than 2-1/4 and not more than 3 times the sum of the separate volumes of cementitious materials.
 - 2. Proportions - Type M:
 - a. 1 Part Portland Cement.
 - b. 1/4 part lime.
 - c. Mortar Aggregate: Not less than 2-1/4 and not more than 3 times the sum of the separate volumes of cementitious materials.

2.3 MORTAR MIXING

- A. Thoroughly mix mortar ingredients in quantities needed for immediate use in accordance with ASTM C270 and Section 2103A.2.1, Part 2, Title 24, CCR and the following
- B. Use mixer with capacity for batches using full sack volumes of cement.
- C. Charge the mixer in the following sequence:
 - 1. 1/2 quantity of sand, water, and admixture and colorant.
 - 2. Full quantity of cement; Partial sack batches are prohibited.
 - 3. 1/2 quantity of sand, water, and admixture and colorant.
 - 4. Full quantity of lime.
 - 5. Additional water as required for workable mix.
- D. If water is lost by evaporation, retemper only within one hour of mixing or prior to cement reaching initial set, whichever occurs first.

2.4 GROUT MIXES

- A. Engineered Masonry: Comply with ASTM C476 and Section 2103A.3, Part 2, Title 24, CCR.
 - 1. Type: Coarse grout for concrete masonry units, fine grout for clay/concrete unit veneer.
 - 2. Slump: 8-11 inches slump at all grouting applications.
 - 3. Strength: Minimum compressive strength as indicated on the Drawings.

2.5 GROUT MIXING

- A. Mix grout concrete in accordance with ASTM C94 and Section 2103A.3, Chapter 21A, Part 2, Title 24, CCR.
- B. Add admixtures in accordance with manufacturer's instructions. Provide uniformity of mix.
- C. Do not use anti-freeze compounds to lower the freezing point of grout.

2.6 OTHER MATERIALS

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

2.7 SOURCE QUALITY CONTROL

- A. Provide for testing under the provisions of Section 01 45 29.
- B. Cement: Section 1910A.1, Part 2, Title 24, CCR.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Inspection
 - 1. Prior to work of this section, carefully inspect previously installed work. Verify all such work is complete to the point where this installation may properly commence.
 - 2. Verify that work of this section may be installed in strict accordance with the original design, all pertinent codes and regulations, and all pertinent portions of the referenced standards.
 - 3. In the event of discrepancy, immediately notify the Architect.
 - 4. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 INSTALLATION

- A. Install mortar and grout to requirements of the specific masonry Sections.

3.3 FIELD QUALITY CONTROL

- A. Test mortar and grout in accordance with Section 01 45 29, including Section 2105A.3, Chapter 21A, Part 2, Title 24, CCR.
- B. Testing of Mortar Mixes:
 - 1. Mortar Test: For each type of mortar, provide mortar tests per ASTM C 1586 .
 - 2. For the first three days of masonry work, prepare three test specimens for each masonry crew.
 - 3. Following the first three days of grouting, prepare one masonry sample per week for each masonry crew. Prepare additional specimens when changes in job conditions or materials occur.
- C. Testing of Grout Mixes:
 - 1. Grout Test: For each grout strength, provide grout sample field tests per ASTM C 1019.
 - 2. For the first three days of grouting, prepare three test specimens for each masonry crew.
 - 3. Following the first three days of grouting, prepare one masonry sample per week for each masonry crew. Prepare additional specimens when changes in job conditions or materials occur.

END OF SECTION 04 05 13

SECTION 04 22 00 CONCRETE UNIT MASONRY



PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Masonry units.
- B. Reinforcement, anchorage, and accessories.

1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

- A. Section 05 50 00 - Metal Fabrications: Placement of fabricated metal items built into masonry.

1.3 REFERENCES

- A. California Building Code (CBC) 2019 edition, as adopted by Authority Having Jurisdiction (AHJ).
- B. ACI 315 - Details and Detailing of Concrete Reinforcement.
- C. ASTM A615- Deformed and Plain Carbon Steel Bars for Concrete Reinforcement.
- D. ASTM A706 - Low Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
- E. ASTM C90 - Loadbearing Concrete Masonry Units.

1.4 QUALIFICATIONS

- A. Installer: Company specializing in performing the work of this Section with minimum 5 years documented experience.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Samples:
 - 1. Submit one full size samples of each block type and color indicating surface texture and color.
 - 2. Certification: Submit certification from block manufacturer confirming compliance with criteria established by referenced standard and this section.
- A. Materials List: Submit proposed materials list for all products used.

B. Shop Drawings

3. Submit steel reinforcement shop drawings in accordance with ACI 315. Include placing drawings and bending charts. Show length and locations of splices, size and length of reinforcing steel, bar position dimensions and spacings.

C. Mock-up

1. Prior to beginning installation, prepare in-place mock-up of approximately 4 foot by 6 foot high, and obtain Architect's approval.

D. Grouting Procedures: Prior to beginning high lift grouting, provide submittal defining proposed grouting procedures. Incorporate DSA IR 21-2, as well as qualification statement of installing contractor demonstrating experience with high lift grouting techniques on Title 24 projects.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Section 01 60 00.

1.7 SEQUENCING AND SCHEDULING

- A. Coordinate work under provisions of Section 01 31 00.

1.8 GUARANTEE

- A. Provide the Owner with a guarantee, in Architect approved form, against the following specific defects or failures for a period of three (3) years after Notice of Substantial Completion:

1. Expansion/contraction cracks.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following or equal:

1. Orco Block Co.
2. Angelus Block Co., Inc.
3. RCP Block & Brick.

- B. Basis of Design: Characteristics of specific products, where named in this Section, are indicated to establish required level of quality, appearance, and performance. Architect will consider requests for substitutions, under the provisions of Section 01 25 00.

2.2 CONCRETE MASONRY UNITS: PRECISION

A. Type:

1. Block: Hollow Load Bearing Block Units per ASTM C90 and Section 2103A.1, Chapter 21A, Part 2, Title 24, CCR.
 - 1) Minimum compressive strength of 2000 psi as a component of design fm assembly value of 2000 psi.
 - 2) Weight Classification All units: Medium Weight (greater than 105 pcf to less than 125 pcf).

B. Size and style

1. Block: Nominal 8 x 8 x 16 and 8 x 16 x 16, hollow load bearing units, double open end at vertical reinforcing, bond beam units at horizontal reinforcing. Provide additional sizes as required and as shown on drawings. Provide stack bond pattern.
2. Provide pilaster units as required for conditions shown on drawings.
3. Provide closed end units at all outside corners and ends.
4. Provide cap block and sill block profiles as shown on drawings.
5. Provide U-lintel solid bottom units at exposed lintel conditions.

C. Finish: Manufacturer's Precision Block finish.

D. Color:

1. Concealed applications: Provide natural gray color.
2. Exposed Applications at Buildings: Provide specified Orco block colors. Color match is critical. Architect will be sole judge of color match when considering acceptability of proposed substitutions.
3. Color 1: Orco block color Tan.

E. Fire Rating: Where masonry units are components in fire rated assemblies, provide written certification of compliance with *Title 24*, UL material listing requirements or other approved material certification methods.

2.3 ACCESSORIES, REINFORCEMENT AND ANCHORAGE

A. Reinforcing Steel: ASTM A 615 or ASTM A 706, in accordance with 2019 CBC, Title 24, CCR, and as specified in Section 03 20 00 of this Project Manual.

B. Mortar and Grout: Per Section 04 05 13.

2.4 SOURCE QUALITY CONTROL AND TESTING

- A. Provide for testing under the provisions of Section 01 45 29.
- B. Masonry Units: 2019 CBC, Part 2, Title 24, CCR.

2.5 OTHER MATERIALS

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

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Inspection
 - 1. Prior to work of this section, carefully inspect previously installed work. Verify all such work is complete to the point where this installation may properly commence.
 - 2. Verify that work of this section may be installed in strict accordance with the original design, all pertinent codes and regulations, and all pertinent portions of the referenced standards.
 - 3. Verify that built-in items are in proper location, and ready for roughing into masonry work.
 - 4. In the event of discrepancy, immediately notify the Architect.
 - 5. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.
- B. PREPARATION
 - 1. Direct and coordinate placement of metal anchors supplied to other Sections.
 - 2. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.
 - 3. Provide templates for setting anchor bolts, maintaining clearances and embedment in compliance with 2019 CBC, Title 24, Part 2, CCR.
- C. COURSING
 - 1. Establish lines, levels, and coursing indicated. Protect from displacement.

2. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
3. Lay masonry units in stacked bond pattern. Course one unit and one mortar joint to equal 8 inches.
4. Joint Tooling:
 - 1) Tool exterior wall joints concave.
 - 2) Tool exposed interior wall joints concave.
 - 3) Tool joints tight and flush at locations where waterproofing or tile finish occurs.
 - 4) Where furring or framing assemblies are installed over masonry, tool joints tight and flush.
5. Surface preparation for waterproofing membranes: Provide smooth mortar parge coat at all block surfaces receiving below grade waterproofing systems, free of ridges, gaps, holes or other surface imperfections.
6. Preparation for flashing assemblies: Where roof or other flashing assemblies butt against or slope against adjoining masonry wall surface, sawcut reglet joint as required to receive flashing termination and as directed by Architect.

D. REINFORCEMENT AND ANCHORAGES - REINFORCED UNIT MASONRY

1. Install reinforcement at spacing indicated and to allow a minimum grout coverage of 1/2 inch or 1 bar diameter, whichever is greater.
2. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
3. Retain vertical reinforcement in position at top and bottom of cells and at intervals not exceeding 192 bar diameters. Splice reinforcement in accordance with Section 03 20 00.
4. Splice reinforcing bars in accordance with 2019 CBC Part 2, Title 24, and as shown on structural drawings.
5. Embed anchors for attachment of metal fabrications.

E. Placing and Bonding

1. Lay masonry in accordance with 2019 CBC Part 2, Title 24, CCR.
2. Perform jobsite cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
3. Lay masonry units with full face shell bedding on bed joints and full head joints.

4. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
5. Lay masonry units with core cells grout space vertically aligned, clear of mortar, and unobstructed with a minimum cell dimension of 3 inches.
6. Interlock intersections and external corners.
7. Where expansion or control joints are shown on structural drawings, provide Type 1 sealant and backer rod as specified in Section 07 92 000 at both sides of joint.
8. Remove excess mortar as Work progresses. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
9. Grout may be placed after mortar has been set and cured. Cure time shall be adequate to prevent blow-outs in high lift grouting operations.

F. Grouting

1. Wet masonry unit surfaces in contact with grout just prior to grout placement.
2. Provide coarse grout.
3. Grout masonry using specified grouting techniques.
 - 1) Maintain weep joints free of grout.
4. When grouting is stopped for more than one hour, terminate grout 1/2 inch below top of upper masonry unit to form a positive key for subsequent grout placement.
5. Low Lift Grouting
 - 1) Conform to requirements of 2019 CBC, Part 2, Title 24, CCR.
 - 2) Install masonry units to a maximum height of 48 inches.
 - 3) Remove all overhanging mortar and mortar droppings.
 - 4) Place grout and mechanically vibrate for grout consolidation.
6. High Lift Grouting:
 - 1) Conform to requirements of 2019 CBC, Part 2, Title 24, CCR, DSA IR 21-2, and the following requirements.
 - 2) Provide clean-out openings at the bottom of each grout pour.
 - 3) Clean out masonry cells, reinforcing and cavities with high pressure water stream. Completely drain cavity and cell bottom of water.
 - 4) Obtain Inspector's review of cleaned cells and cavities.

- 5) After review, seal opening with masonry face shell.
- 6) Pump grout into cells. Maintain water content in grout as required to achieve required slump without aggregate segregation.
- 7) Place grout in maximum 4 foot lifts. Provide initial grout consolidation by mechanical vibration.
- 8) After the grout has become plastic, but before any setting has occurred, place next grout lift. In normal weather conditions, delay placing subsequent grout lifts for 30 minutes minimum, and 60 minutes maximum. Reconsolidate the preceding grout lift by mechanical vibration, and repeat procedure.

G. BUILT - IN WORK

1. As work progresses, build in anchor bolts, plates, and other items furnished by other Sections.
2. Build in items plumb and level.
3. Do not build in pipes or ducts unless specifically detailed by the Structural Engineer.
4. Do not build in organic materials subject to deterioration.

H. TOLERANCES

1. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
2. Maximum Variation From Plane of Wall: 1/4 inch in 10 feet and 1/2 inch in 20 feet or more.
3. Maximum Variation From Plumb: 1/4 inch per story non-cumulative.
4. Maximum Variation From Level Coursing: 1/8 inch in 3 feet and 1/4 inch in 10 feet; 1/2 inch in 30 feet.
5. Maximum Variation of Joint Thickness: 1/8 inch in 3 feet.

I. CUTTING AND FITTING

1. Cut and fit for chases, pipes, conduit, sleeves, grounds, and other penetrations. Coordinate with other Sections of work to provide correct size, shape, and location.
2. Obtain Architect approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

J. CLEANING

1. Clean work under provisions of Section 01 77 00.

2. Remove excess mortar and mortar smears.
3. Replace defective mortar. Match adjacent work.
4. Use non-metallic tools in cleaning operations.
5. Do not use acid or acid base cleaning agents.

K. PROTECTION OF FINISHED WORK

1. Protect finish installation under provisions of Section 01 73 00.
2. Without damaging completed work, provide protective boards at exposed external corners which may be damaged by construction activities.

L. FIELD QUALITY ASSURANCE

1. Perform testing and inspection under the provisions of Section 01 45 29.
2. Masonry Inspection: Provide inspection per 2019 CBC, Part 2, Title 24, CCR.
3. Masonry Testing: Provide testing per 2019 CBC, Part 2, Title 24, CCR.
4. Masonry Core Tests: Provide masonry core tests for each different masonry compressive strength in accordance with 2019 CBC,, Part 2, Title 24, CCR.

END OF SECTION 04 22 00

SECTION 051200
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. Section Includes:
 - 1. Structural steel.
 - 2. Field-installed shear connectors.
 - 3. Grout.
- B. Related Requirements:
 - 1. Section 05 31 00 "Steel Decking" for field installation of shear connectors through deck.
 - 2. Section 05 50 00 "Metal Fabrications" for miscellaneous steel fabrications and other steel items not defined as structural steel.
 - 3. Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting"

1.3 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.
- C. Heavy Sections: Rolled and built-up sections as follows:
 - 1. Shapes included in ASTM A 6 with flanges thicker than 1-1/2 inches.
 - 2. Welded built-up members with plates thicker than 2 inches.
 - 3. Column base plates thicker than 2 inches.
- D. Protected Zone: Structural members or portions of structural members indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.
- E. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Load-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on Drawings.

1.4 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 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.

1.5 PREINSTALLATION MEETINGS

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

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- 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. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
 - 5. Identify members and connections of the Seismic-Load-Resisting System.
 - 6. Indicate locations and dimensions of protected zones.
 - 7. Identify demand critical welds.
- C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1 & D1.8, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:
 - 1. Power source (constant current or constant voltage).
 - 2. Electrode manufacturer and trade name.
- D. CHPS Submittals:
 - 1. Product Data for Credits EQ7.0: For primers, documentation including printed statement of VOC compliance and other requirements per 01 81 13 "High Performance School Requirements".

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer fabricator shop-painting applicators testing agency.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Mill test reports for structural steel, including chemical and physical properties.
- E. Product Test Reports: For the following:
 - 1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 2. Direct-tension indicators.
 - 3. Tension-control, high-strength, bolt-nut-washer assemblies.
 - 4. Shear stud connectors.
 - 5. Shop primers.
 - 6. Nonshrink grout.

1.8 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator shall have a minimum of five years experience in similar types of fabrication, and participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD, or is accredited by the IAS Fabricator

Inspection Program for Structural Steel (AC 172) or that is approved by the Los Angeles Department of Building & Safety.

- B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1 & D1.8, "Structural Welding Code - Steel."
 - 1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.
- D. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC 303.
 - 2. AISC 341 and AISC 341s1.
 - 3. AISC 360.
 - 4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver structural steel to the Project Site in such quantities and at such times to ensure continuity of installation.
- B. 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 corrosion and deterioration.
 - 1. 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.
- C. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 - 1. Fasteners may be repackaged provided District's testing and inspecting agency observes repackaging and seals containers.
 - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 - 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 572 or A992, Grade 50].
- B. Channels, Angles-Shapes: ASTM A 36 unless noted otherwise.
- C. Plate and Bar: ASTM A 36 unless noted otherwise on plans.
- D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.
- E. Steel Pipe: ASTM A 53, Type E or Type S, Grade B.
 - 1. Weight Class: Standard unless noted otherwise on plans.
 - 2. Finish: Black except where indicated to be galvanized.
- F. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. Non-High-Strength Bolts, Nuts, and Washers: Provide unless otherwise noted. ASTM A 307, Grade A carbon-steel, hex-headed bolts, carbon-steel nuts, and flat, unhardened steel washers.
 - 1. Finish: Plain, uncoated.
- B. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with plain finish.
- C. 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, Grade DH, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers with plain finish.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 490, compressible-washer type with plain finish.
- D. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers.
 - 1. Finish: Hot-dip zinc coating.
 - 2. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with mechanically deposited zinc coating plain, uncoated finish.
- E. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, round head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
 - 1. Finish: Plain unless noted otherwise.
- F. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.
- G. Anchor Rods: ASTM F 1554, Grade 36 unless noted otherwise, straight.
 - 1. Nuts: ASTM A 563 heavy-hex carbon steel.
 - 2. Plate Washers: ASTM A 36/A 36M carbon steel.
 - 3. Washers: ASTM F 436, Type 1, hardened carbon steel.
 - 4. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.
- H. Threaded Rods: ASTM A 36 unless noted otherwise.
 - 1. Nuts: ASTM A 563 heavy-hex carbon steel.
 - 2. Washers: ASTM F 436, Type 1, hardened carbon steel.
 - 3. Finish: Hot-dip zinc coating, ASTM A 153, Class C.
- I. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.

2.3 PRIMER

- A. Primer: Comply with Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."
- B. Primer: SSPC-Paint 25 Type II, zinc oxide, alkyd, linseed oil primer.

- C. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer compatible with topcoat.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds and repair painting galvanized steel, with dry film containing not less than 93 percent zinc dust by weight, and complying with ASTM A 780/A 780M.

2.4 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, 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 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.
 - 1. Camber structural-steel members where indicated.
 - 2. Fabricate beams with rolling camber up.
 - 3. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.
 - 4. Mark and match-mark materials for field assembly.
 - 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
 - 6. Fabricate for delivery a sequence that will expedite erection and minimize field handling of structural steel.
- B. Fabricate architecturally exposed structural steel with exposed surfaces smooth, square, and free of surface blemishes, including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness.
 - 1. Remove blemishes by filling, grinding, or by welding and grinding prior to cleaning, treating and shop priming.
 - 2. Comply with fabrication requirements, including tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for architecturally exposed structural steel.
- C. 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.
- D. Bolt Holes: drill or punch standard bolt holes perpendicular to metal surfaces.
- E. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- F. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 3, "Power Tool Cleaning."
- 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.
- H. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural-steel frame. Straighten as required to provide uniform, square, and true members in completed wall framing. Build up welded framing, weld exposed joints continuously, and grind smooth.

- I. Welded Door Frames: Build up welded door frames attached to structural-steel frame. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk machine screws, uniformly spaced not more than 10 inches o.c. unless otherwise indicated.
- J. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 - 2. Baseplate Holes: Cut, drill, 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. Shop install and tighten non-high-strength bolts.
- B. 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 or Slip critical.
- C. Weld Connections: Comply with AWS D1.1 and AWS D1.8 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.
 - 2. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds 1/2-inch and larger. Grind flush butt welds. Dress exposed welds.

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 of high-strength bolted, slip-critical connections.
 - 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
 - 5. Galvanized surfaces.
 - 6. Surfaces enclosed in interior construction.
- 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 3, "Power 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 minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 - 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

- D. Painting: Prepare steel and apply a one-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils.

2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123.
 - 1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
 - 2. Steel connection components, including bolts, washers and nuts, shall be galvanized by the hot-dip process conforming to ASTM A 153.
 - 3. All required hot-dip galvanizing shall be done after fabrication, in the largest sections possible.
 - 4. Items too large for available dip tanks shall be sprayed, by approved methods, with zinc coating thickness of 0.003 inch to 0.004 inch.
 - 5. Appearance Criteria: Where galvanized steel is exposed to view in the final construction, take special care to produce a uniform and consistent coating, including the following provisions:
 - a. Consult with galvanizer for proper zinc characteristics that allow for a uniform and consistent application. The galvanizer may choose to add trace amounts of certain elements (for example, aluminum nickel and tin) to the zinc bath to help in the processing of certain reactive steels to enhance the finished appearance. Maintain 98.0% zinc by weight minimum.
 - b. Upon shipment from the galvanizing facility, galvanized articles shall be free from uncoated areas, blisters, flux deposits, lumps and projections.
 - c. The coating shall be continuous, and reasonably smooth and uniform in thickness.

2.9 SOURCE QUALITY CONTROL

- A. Testing Agency: The District will engage a qualified testing agency to perform shop tests and inspections.
 - 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 - 1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- 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 303 and AISC 360.
- B. Baseplates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 2. Weld plate washers to top of baseplate where noted.
 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 plate before packing with grout.
 4. Promptly pack grout solidly between bearing surfaces and 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 303, "Code of Standard Practice for Steel Buildings and Bridges."
- D. Maintain erection tolerances of architecturally exposed structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- E. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are 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.
- F. Splice members only where indicated.
- G. Do not use thermal cutting during erection unless approved by the District Construction Manager. Finish thermally cut sections within smoothness limits in AWS D1.1.
 1. Finish sections thermally cut during erection equal to a sheared appearance.
- H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- I. Remove erection bolts on welded, architecturally exposed structural steel. Fill holes with plug welds, and grind smooth at exposed surfaces.
- J. 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. Non-high-strength bolts: Install and tighten non-high-strength bolts, except where high-strength bolts are indicated.

- B. 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 or Slip critical.
- C. Weld Connections: Comply with AWS D1.1 and AWS D1.8 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 - 2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
 - 3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.
 - 4. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds 1/2-inch and larger. Grind flush butt welds. Dress exposed welds.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: The District will engage a qualified special inspector to perform the following special inspections:
 - 1. Verify structural-steel materials and inspect steel frame joint details.
 - 2. Verify weld materials and inspect welds.
 - 3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: The District will engage a qualified testing agency to perform tests.
- C. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

3.6 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.
- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
- C. Touchup Painting: Cleaning and touchup painting are specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."

END OF SECTION 05 12 00

SECTION 053100 STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Roof deck.
 - 2. Composite floor deck.
- B. Related Requirements:
 - 1. Section 03 30 00 "Cast-in-Place Concrete" for normal-weight and lightweight structural concrete fill over steel deck.
 - 2. Section 05 12 00 "Structural Steel Framing" for shop- and field-welded shear connectors.
 - 3. Section 05 50 00 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
 - 4. Section 09 91 13 "Exterior Painting" for repair painting of primed deck and finish painting of deck.
 - 5. Section 09 91 23 "Interior Painting" for repair painting of primed deck and finish painting of deck.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. Shop Drawings:
 - 1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.
- C. CHPS Submittals:
 - 1. Product Data for Credits EQ7.0: For primers, documentation including printed statement of VOC compliance and other requirements per 01 81 13 "High Performance School Requirements".

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Product Certificates: For each type of steel deck.
- C. Product Test Reports: For tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
 - 1. Acoustical roof deck.
- D. Evaluation Reports: For steel deck, from ICC-ES.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
 - 1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

1.7 COORDINATION

- A. Coordinate installation of sound-absorbing insulation strips in topside ribs of acoustical deck with roofing installation as specified in applicable Roofing Section to ensure protection of insulation strips against damage from effects of weather and other causes.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- B. 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 ROOF DECK

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ASC Profiles, Inc.
 - 2. Nucor Corp.
 - 3. Verco Decking, Inc., a Nucor company.
 - 4. Or equal.
- B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
 - 1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 G60
 - 2. Deck Profile: As indicated.
 - 3. Profile Depth: As indicated.
 - 4. Design Uncoated-Steel Thickness: As indicated.
 - 5. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: As indicated.
 - 6. Span Condition: As indicated.
 - 7. Side Laps: Interlocking seam.

2.3 COMPOSITE FLOOR DECK

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ASC Profiles, Inc.
 - 2. Nucor Corp.

3. Verco Decking, Inc., a Nucor company.
 4. Or Equal.
- B. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G60 zinc coating.
 2. Profile Depth: As indicated
 3. Design Uncoated-Steel Thickness: As indicated.
 4. Span Condition: As indicated.

2.4 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Side-Lap Fasteners: Mechanically fastened with manufacturer's tool, i.e. punchlock.
- C. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- D. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- E. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile indicated.
- F. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
- G. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.
- H. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch thick, with factory-punched hole of 3/8-inch minimum diameter.
- I. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.
- J. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch-wide flanges and level recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.
- K. Shear Connectors: ASTM A 108, Grades 1010 through 1020 headed stud type, cold-finished carbon steel, AWS D1.1, Type B, with arc shields.
- L. Galvanizing Repair Paint: ASTM A 780 or SSPC-Paint 20 or MIL-P-21035B, with dry film containing a minimum of 94 percent zinc dust by weight.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
 - 1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
 - 1. Weld Diameter: 3/4 inch, nominal.
 - 2. Weld Spacing: Space welds as indicated on drawings. .
 - 3. Weld Washers: Install weld washers at each weld location only when required by the manufacturer.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports as indicated on drawings.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - 1. End Joints: Lapped 2 inches minimum.
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld flanges to top of deck. Space welds not more than 12 inches apart with at least one weld at each corner.
 - 1. Install reinforcing channels or zees in ribs to span between supports and weld.
- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.
 - 1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

- F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.
- G. Sound-Absorbing Insulation: Installation into topside ribs of acoustical roof deck as specified in Section.

3.4 FLOOR-DECK INSTALLATION

- A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
 - 1. Weld Diameter: 3/4 inch, nominal.
 - 2. Weld Spacing: As indicated.
 - 3. Weld Spacing: Space and locate welds as indicated.
 - 4. Weld Washers: Install weld washers at each weld location if required by manufacturer.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports as indicated.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - 1. End Joints: Lapped or Butted.
- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.
- E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: The District will engage a qualified testing agency to perform tests and inspections.
- B. Remove and replace work that does not comply with specified requirements.
- C. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 31 00

SECTION 054000
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. Section Includes:
 - 1. Exterior non-load-bearing wall framing.
 - 2. Ceiling joist framing.
 - 3. Soffit framing.
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for masonry shelf angles and connections.
 - 2. Section 092900 "Gypsum Board"
 - 3. Section 092216 "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of cold-formed steel framing product and accessory.
- B. Shop Drawings:
 - 1. Include sizes, thicknesses, and types of cold-formed steel framing; including mechanical fasteners.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Mill certificates signed by steel sheet producer or test reports from a qualified independent testing agency indicating steel sheet complies with requirements. Product Test Reports: For each listed product, for tests performed by a qualified testing agency.
 - 1. Steel sheet.
 - 2. Expansion anchors.
 - 3. Power-actuated anchors.
 - 4. Mechanical fasteners.
 - 5. Vertical deflection clips.
 - 6. Horizontal drift deflection clips
 - 7. Miscellaneous structural clips and accessories.
- D. Research Reports: For non-standard cold-formed steel framing, from ICC-ES.

1.6 QUALITY ASSURANCE

- A. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code - Steel."
 - 2. AWS D1.3, "Structural Welding Code - Sheet Steel."
- C. Comply with AISI S230 "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed steel framing from corrosion, moisture staining, 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 products by one of the following:
 - 1. CEMCO; California Expanded Metal Products Co.
 - 2. ClarkDietrich Building Systems.
 - 3. United Metal Products, Inc.
 - 4. Or Equal.

2.2 PERFORMANCE REQUIREMENTS

- A. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.
- B. 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.

2.3 COLD-FORMED STEEL FRAMING, GENERAL

- A. Steel Sheet: ASTM A 1003, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 - 1. Grade: As indicated.
 - 2. Coating: G60.
- B. Steel Sheet for Vertical Deflection or Drift Clips: ASTM A 653, structural steel, zinc coated, of grade and coating as follows:
 - 1. Grade: As indicated.
 - 2. Coating: G60.

2.4 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 indicated.
 - 2. Flange Width: As indicated.
- 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 indicated.
 - 2. Flange Width: As indicated.
- C. Vertical Deflection Clips: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Simpson Strong-Tie Co., Inc.
 - b. ClarkDietrich Building Systems.
 - c. Steel Network, Inc. (The).
 - d. Or equal.
- D. 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 loads and transfer them to the primary structure, and as follows:
 - 1. Deflection track flange is usually designed to be thicker than corresponding studs to resist transverse loading. Coordinate flange width with deflection of primary structure to ensure that structure does not bear on framing.
 - 2. Minimum Base-Metal Thickness: As indicated.
 - 3. Flange Width: As indicated.
- E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
 - 1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 - a. Minimum Base-Metal Thickness: As indicated.
 - b. Flange Width: As indicated.
 - 2. Inner Track: Of web depth indicated, and as follows:
 - a. Minimum Base-Metal Thickness: As indicated.
 - b. Flange Width: As indicated.
- F. 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 through positive mechanical attachment to stud web and structure.

2.5 CEILING JOIST FRAMING

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

2.6 SOFFIT FRAMING

- A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: As indicated.
 - 2. Flange Width: As indicated.

2.7 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. Supplementary framing.
 - 2. Bracing, bridging, and solid blocking.
 - 3. Web stiffeners.
 - 4. Anchor clips.
 - 5. End clips.
 - 6. Foundation clips.
 - 7. Gusset plates.
 - 8. Stud kickers and knee braces.
 - 9. Joist hangers and end closures.
 - 10. Hole reinforcing plates.
 - 11. Backer plates.

2.8 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36, zinc coated by hot-dip process according to ASTM A 123.
- B. Anchor Bolts: ASTM F 1554, Grade 36 unless noted otherwise, 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 allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.
- D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified 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.

2.9 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B or ASTM A 780.

- B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. 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/C 1107M, with fluid consistency and 30-minute working time.
- D. Shims: Load bearing, high-density multimonomer plastic, and nonleaching; or of cold-formed steel of same grade and coating as framing members supported by shims.
- E. 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.

2.10 FABRICATION

- A. Fabricate cold-formed steel 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 steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M 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 no fewer than three exposed screw threads.
 - 4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening.
- 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 steel 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 of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Install load bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.
- B. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200 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 steel 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 steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners 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 joints with cold-formed steel framing. Independently frame both sides of joints.
- H. Install insulation, specified in Section 072100 "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 approved or standard punched openings.
- J. Erection Tolerances: Install cold-formed steel 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: 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 deep-leg deflection tracks and anchor to building structure.
 2. Install double deep-leg deflection tracks and anchor outer track to building structure.
 3. Connect vertical deflection clips to bypassing studs and anchor to building structure.
 4. Connect drift clips to cold-formed metal framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced as indicated.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, 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.
- B. Install joists, 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.
- C. Space joists as indicated on Drawings.
- D. Frame openings with built-up joist headers consisting of joist and joist track, 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.
- G. 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 FIELD QUALITY CONTROL

- A. Testing: The District will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

- B. Field and shop welds will be subject to testing and inspecting.
- C. Remove and replace work where test results indicate that it does not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel 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 steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 055000 - METAL FABRICATIONS

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. Steel framing and supports for overhead doors.
 - 2. Steel framing and supports for countertops.
 - 3. Steel tube reinforcement for low partitions.
 - 4. Steel framing and supports for mechanical and electrical equipment.
 - 5. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - 6. Elevator hoist beams.
 - 7. Steel shapes for supporting elevator door sills.
 - 8. Shelf angles.
 - 9. Metal ladders.
 - 10. Ladder safety cages.
 - 11. Metal floor plate.
 - 12. Metal bollards.
 - 13. Exterior column covers.
 - 14. Custom perforated metal panels.
 - 15. Perforated sheet metal.
- B. Products furnished, but not installed, under this Section include the following:
- C.
 - 1. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete.
 - 2. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.
- D. Related Requirements:
 - 1. Section 033000 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
 - 2. Section 051200 "Structural Steel Framing."
 - 3. Section 32 93 00 "Plants" for tree grates.

1.3 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 metal fabrications that are anchored to or that receive other work. 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.

1.4 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. Provide Shop Drawings for the following:
 - 1. Steel framing and supports for overhead doors.
 - 2. Steel framing and supports for countertops.
 - 3. Steel tube reinforcement for low partitions.
 - 4. Steel framing and supports for mechanical and electrical equipment.
 - 5. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - 6. Elevator machine beams, hoist beams,.
 - 7. Steel shapes for supporting elevator door sills.
 - 8. Shelf angles.
 - 9. Metal ladders.
 - 10. Ladder safety cages.
 - 11. Metal ships' ladders.
 - 12. Metal floor plate.
 - 13. Metal bollards.
 - 14. Pipe guards.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer.
- B. Mill Certificates: Signed by stainless-steel manufacturers, certifying that products furnished comply with requirements.
- C. Welding certificates.
- D. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.7 FIELD CONDITIONS

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

1.8 REGULATORY REQUIREMENTS

- A. Comply with California Fire Code (CFC) Chapter 35.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. 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, material surfaces.

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. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304.
- D. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- E. 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.
- F. Rolled-Stainless-Steel Floor Plate: ASTM A 793.
- G. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- H. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.
- I. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 - 1. Size of Channels: 1-5/8 by 1-5/8 inches.
 - 2. Material: Galvanized steel, ASTM A 653/A 653M, commercial steel, Type B, with G90coating; 0.064-inch nominal thickness.
 - 3. Material: Cold-rolled steel, ASTM A 1008/A 1008M, commercial steel, Type B; 0.0966-inch minimum thickness; hot-dip galvanized after fabrication.
- J. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.
- K. Aluminum Plate and Sheet: ASTM B 209, Alloy 6061-T6.
- L. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.
- M. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- N. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.
- O. Nickel Silver Extrusions: ASTM B 151/B 151M, Alloy UNS No. C74500.

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.
 - 1. Provide stainless-steel fasteners for fastening aluminum.
 - 2. Provide stainless-steel fasteners for fastening stainless steel.
 - 3. Provide stainless-steel fasteners for fastening nickel silver.

4. Provide bronze fasteners for fastening bronze.
 - B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
 - C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1.
 - D. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
 - E. 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.
 - F. Post-Installed Anchors: Torque-controlled expansion anchors.
 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.
 - G. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.
- 2.4 MISCELLANEOUS MATERIALS.
- A. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting."
 - B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer and compatible with topcoat.
 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
 - C. Epoxy Zinc-Rich Primer: Compatible with topcoat.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carboline Company.
 - b. PPG Paints.
 - c. Rust-Oleum.
 - d. Sherwin-Williams Company.
 - e. Or Equal.
 - D. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
 - E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
 - F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

- G. 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.
- H. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

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.
 - 1. Fabricate units from slotted channel framing where indicated.
 - 2. Furnish inserts for units installed after concrete is placed.

- C. Galvanize miscellaneous framing and supports where indicated.
- D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.
- E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.7 METAL LADDERS

- A. General:
 - 1. Comply with ANSI A14.3, except for elevator pit ladders.
 - 2. For elevator pit ladders, comply with ASME A17.1/CSA B44.
- B. Aluminum Ladders:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. O'Keeffe's Inc.
 - b. Precision Ladders, LLC.
 - c. Royalite Manufacturing, Inc.
 - d. Or Equal.
 - 2. Space siderails 18 inches apart unless otherwise indicated.
 - 3. Siderails: Continuous extruded-aluminum channels or tubes, not less than 2-1/2 inches deep, 3/4 inch wide, and 1/8 inch thick.
 - 4. Rungs: Extruded-aluminum tubes, not less than 3/4 inch deep and not less than 1/8 inch thick, with ribbed tread surfaces.
 - 5. Fit rungs in centerline of siderails; fasten by welding or with stainless-steel fasteners or brackets and aluminum rivets.

2.8 LADDER SAFETY CAGES

- A. General:
 - 1. Fabricate ladder safety cages to comply with ANSI A14.3. Assemble by welding or with stainless-steel fasteners.
 - 2. Provide primary hoops at tops and bottoms of cages and spaced not more than 20 feet o.c. Provide secondary intermediate hoops spaced not more than 48 inches o.c. between primary hoops.
 - 3. Fasten assembled safety cage to ladder rails and adjacent construction by welding or with stainless-steel fasteners unless otherwise indicated.
- B. Aluminum Ladder Safety Cages:
 - 1. Primary Hoops: 1/4-by-4-inch flat bar hoops.
 - 2. Secondary Intermediate Hoops: 1/4-by-2-inch flat bar hoops.
 - 3. Vertical Bars: 1/4-by-2-inch flat bars secured to each hoop.

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.
 - 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

- C. Galvanize interior and exterior miscellaneous steel trim where indicated.
- D. Prime interior and exterior miscellaneous steel trim with zinc-rich primer where indicated.

2.10 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 40 steel pipe.
 - 1. Cap bollards with 1/4-inch-thick steel plate.
 - 2. Where bollards are indicated to receive controls for door operators, provide cutouts for controls and holes for wire.
 - 3. Where bollards are indicated to receive light fixtures, provide cutouts for fixtures and holes for wire.
- B. Fabricate sleeves for bollard anchorage from steel pipe with 1/4-inch-thick steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches deep and 3/4 inch larger than OD of bollard.
- C. Fabricate internal sleeves for removable bollards from Schedule 40 steel pipe or 1/4-inch wall-thickness steel tubing with an OD approximately 1/16 inch less than ID of bollards. Match drill sleeve and bollard for 3/4-inch steel machine bolt.
- D. Galvanize metal bollards and sleeves after fabrication.

2.11 EXTERIOR COLUMN COVER

- A. Column cover: Standard Wet System preformed and prefinished architectural column cover; round, two panel, aluminum composite material, size as indicated on drawings.
- B. Manufacturers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. C.R. Laurence Co., Inc.,
 - b. Fry Reglet Architectural Metals.
 - c. Pac-Clad.
 - d. Or Equal.

2.12 CUSTOM SHEET METAL PANEL

- A. Manufacturers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Zahner, ImageWall custom.
 - b. Parasoleil, custom.
 - c. Revamp Panels, LLC, custom.
 - d. Or Equal.
 - 2. Material: Aluminum.
 - 3. Thickness: .25 inch
 - 4. Finish: Factory applied powder coat. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Color as selected by Architect from full range.
 - 5. Pattern: Custom perforated.
 - 6. Hardware: Parasoleil or equal.
 - a. Perimeter of panel array: PFL-200

- b. Interior at panel seams: PFL-400

2.13 SHEET METAL PANEL

A. Fence/ Gate:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Parasoleil, equal to White Sands pattern.
 - b. Zahner.
 - c. Revamp Panels, LLC.
 - d. Or Equal.
2. Material: Aluminum.
3. Thickness: .063 inch
4. Finish: Factory applied powder coat. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Color as selected by Architect from full range.

B. Shade:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Parasoleil, equal to Kenyan pattern.
 - b. Zahner.
 - c. Revamp Panels, LLC.
 - d. Or Equal.
2. Material: Aluminum.
3. Thickness: .25 inch
4. Finish: Factory applied powder coat. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Color as selected by Architect from full range.

C. Perforated Round Hole:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:
 - a. McNichols Co., www.mcnichols.com, (877)-884-4653.
 - b. Parasoleil.
 - c. Zahner.
 - d. Revamp Panels, LLC.
 - e. Or Equal.
 - 1) Product Line: Perforated.
 - 2) Product Type: Round hole.
 - 3) Material: 20 gauge aluminum.
 - 4) Percent Open Area: 40 percent open.
 - 5) Weight: 0.33 #/SF.
 - 6) Perforation: 1/8 inch round on 3/16 inch staggered.
 - 7) Finish: Factory applied powder coat. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed

metal surfaces to comply with coating and resin manufacturers' written instructions. Color as selected by Architect from full range.

D. Solid:

- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Parasoleil.
 - 2) Zahner.
 - 3) Revamp Panels, LLC.
 - 4) Or Equal.
2. Material: Aluminum.
3. Thickness: .063 inch
4. Finish: Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Color as selected by Architect from full range.

2.14 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.

2.15 FABRICATED GATE HARDWARE AND COMPONENTS

- A. Manufacturer: Guardian, phone 520-320-1810, www.guardiangatehardware.com, or equal.
 1. Swing gate hinges:
 - a. At gates up to 4 feet in width, provide Guardian 2000.200, galvanized finish, 2 per leaf.
 - b. At gates greater than 4 feet but less than 8 feet in width, provide Guardian 2000.200, galvanized finish, 2 per leaf.
 - c. At gates greater than 8 feet in width, provide Guardian 2000.200, galvanized finish, 3 per leaf.
 2. Cane Bolt: steel, 1/2 inch diameter, with locking tab and guide angles for welded attachment.
 3. Knox Box: Provide Knox Box Model 3200 at each gate per plans. Provide steel backing plate for attachment, 1/4 inch thick, welded to gate frame.
 4. Kick Panel: Provide steel plate full width of gate on each side, 10 inches high x 1/4 inch thick, welded to gate. Ease all edges.

2.16 FINISHES, GENERAL

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.17 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.
 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
 - C. 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.
 - 1. Shop prime with universal shop primer.
 - D. 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. Other Items: SSPC-SP 3, "Power Tool Cleaning."
 - E. 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.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
- 2.18 ALUMINUM FINISHES
- A. As-Fabricated Finish: AA-M12.
 - B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

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

- F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
 - 1. Cast Aluminum: Heavy coat of bituminous paint.
 - 2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

3.3 INSTALLING METAL BOLLARDS

- A. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete. Fill annular space around bollard solidly with nonshrink grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.
- B. Fill bollards solidly with concrete, mounding top surface to shed water.
 - 1. Do not fill removable bollards with concrete.

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.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting."
- C. 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 055113 METAL PAN STAIRS

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. Steel pan stairs with perforated metal risers and concrete-filled treads.
- B. Related Requirements:
 - 1. Section 033000 "Cast-in-Place Concrete" for concrete filled treads and landings.
 - 2. Section 055213 "Pipe and Tube Railings" for pipe and tube railings.
 - 3. Section 055000 "Metal Fabrications" for perforated metal risers and custom plate guardrails.
 - 4. Section 099113 "Exterior Painting"

1.3 ACTION SUBMITTALS

- A. Product Data: For metal pan stairs and the following:
 - 1.
 - 2. Nonslip aggregates and nonslip-aggregate finishes.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
- C. Regulatory Requirements:
 - 1. Interior stairs shall have the upper approach and lower tread marked by a stripe providing clear visual contrast. Exterior stairs shall have the upper approach and all treads marked by a stripe providing clear visual contrast.
 - 2. The stripe providing clear visual contrast shall be a minimum of 2" wide to a maximum of 4" wide placed parallel to, and not more than 1" from, the nose of the step or upper approach. The stripe shall extend the full width of the step or upper approach and shall be of material that is at least as slip resistant as the other treads of the stair. A painted stripe shall be acceptable. Grooves shall not be used to satisfy this requirement.
 - 3. The radius of curvature at the leading edge of the tread shall be no greater than ½". Nosings that project beyond risers shall have the underside of the leading edge curved or

- beveled. The maximum angle for a riser to slope under the tread shall be 30 degrees from vertical. Nosings shall extend 1 1/4" maximum over the tread below.
4. Treads shall be 1 1/2" deep minimum. Risers shall be 7" high maximum and 4" high minimum. All steps on a flight of stairs shall have uniform riser heights and uniform tread depths. Open risers are not permitted.

PART 2 - PRODUCTS

2.1 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Steel Tubing: ASTM A 500 (cold formed).
- D. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, either commercial steel, Type B, or structural steel, Grade 30, unless another grade is required by design loads.
- E. Perforated Metal Risers per 055000.

2.2 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
 - 1. Provide hot-dip, zinc-coated anchor bolts for exterior stairs.
- D. Post-Installed Anchors: As indicated.
- E. Machine Screws: ASME B18.6.3.
- F. Plain Washers: Round, carbon steel, ASME B18.22.1.
- G. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.3 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

- D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

2.4 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 - 1. Join components by welding unless otherwise indicated.
 - a. Shop fabricate and weld as much as possible, field weld only when necessary.
 - b. Bolted connections shall be used for perforated metal risers.
 - 2. Use connections that maintain structural value of joined pieces.
- B. Shop Assembly: Shop Fabricate and Shop Assemble stairs to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. 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.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work with accurate angles and surfaces and straight edges.
- F. Weld connections 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. Weld exposed corners and seams continuously unless otherwise indicated.
 - 5. 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 surfaces. Comply with NOMMA's "Voluntary Joint Finish Standards" for Type 4 welds: good quality, uniform undressed weld with minimal splatter.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

2.5 STEEL-FRAMED STAIRS

- A. Stair Framing:
 - 1. Fabricate stringers of structural steel tubes or channels as indicated.
 - a. Provide closures for exposed ends of tube stringers per details.
 - 2. Construct platforms of steel tube or channel headers and miscellaneous framing members as indicated.
 - 3. Weld or bolt stringers to headers as indicated.
- B. Metal Pan Stairs: Form risers, subread pans, and subplatforms to configurations shown from steel sheet of thickness indicated.
 - 1. Steel Sheet: Uncoated hot-rolled steel sheet unless otherwise indicated.

2. Steel Sheet: Galvanized-steel sheet, where indicated.

2.6 STAIR RAILINGS

- A. Comply with applicable requirements in Section 055000 "Metal Fabrications, and 055213 "Pipe and Tube Railings."

2.7 FINISHES

- A. Shop Finish metal stairs after fabrication.
- B. 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.
 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
- D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLING METAL PAN STAIRS

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where indicated for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- D. 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.
- E. Field Welding: Comply with requirements for welding in "Fabrication, General" Article. Ensure ALL welds (field and shop) are ground smooth and patched and filled to smooth surface prior to finishing.
- F. Place and finish concrete fill for treads and platforms to comply with Section 033000 "Cast-in-Place Concrete." Ensure all concrete spillage, splash, and residue is wiped completely clean while wet as not to damage metal finishes.

3.2 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 099113 "Exterior Painting". All touch-up finishing shall be indistinguishable from previous finish applications.
- 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 055113

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Steel pipe and tube railings.
 - 2. Open grill railing system.
- B. Related Requirements:
 - 1. Section 055113 "Metal Pan Stairs" for steel tube railings associated with metal pan stairs.

1.2 COORDINATION

- A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. 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.
 - 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 each type of exposed finish required.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For pipe and tube railings, for 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 the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 REGULATORY REQUIREMENTS

- A. 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.
- B. Clearance between handrail gripping surfaces and adjacent surfaces shall be 1 1/2 inch minimum. Handrail may be located in a recess if the recess is 3 inch maximum deep and 18 inches minimum clear above the top of the handrail.
- C. 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% of their length. Where provided, horizontal projections shall occur 1 ½ inch minimum below the bottom of the handrail gripping surfaces.

- D. Handrail gripping surfaces with a circular cross section shall have an outside diameter of 1 ¼ inch minimum and 2 inch maximum.
- E. Handrail gripping surfaces with a non-circular cross section shall have an outside dimension of 4 inch minimum and 6 ¼ inch maximum, and a cross-sectional dimension of 2 ¼ inch maximum.
- F. Handrail gripping surfaces and any surfaces adjacent to them shall be free of sharp or abrasive elements and shall have rounded edges.
- G. Handrails shall not rotate within their fittings.
- H. 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.
- I. A 2 inch minimum high curb or barrier shall be provided to prevent the passage of a 4 inch diameter sphere rolling off the edges on a ramp or landing surface. Such a curb or barrier shall be continuous and uninterrupted along the length of a ramp. CBC Section 11B-405.9.2.

1.7 DELIVERY, STORAGE, AND HANDLING

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

1.8 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 PERFORMANCE REQUIREMENTS

- A. 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.
 - b. Concentrated load of 200 lb 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.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent 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 PERFORMANCE REQUIREMENTS

- A. .

- 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.
 - b. Concentrated load of 200 lbfapplied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbfapplied horizontally on an area of 1 sq. ft..
 - b. Infill load and other loads need not be assumed to act concurrently.

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 with flange tapped for concealed anchorage to threaded hanger bolt and 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).
- 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.
 - 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. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 for zinc coating.
 - 2. 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.
 - 3.
- 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. Post-Installed Anchors: Torque-controlled expansion anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
 - 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.

2.6 OPEN GRILL STEEL RAILING SYSTEM

- A. Welded steel grillwork.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:
 - a. Grating Pacific, Inc..
 - b. Or equal.
 - 2. Material
 - a. Type: Equal to Grating Pacific, ÓCoda ArchitecturalÓOpus10• .
 - b. Finish: Galvanized.
 - c. Infill Panel Material: Steel, ASTM A 1011.
 - d. Flat Bars: ASTM A 36 or A 1011.
 - e. Angles and Channels: ASTM A 36.
 - f. Tubing: ASTM A 500.
 - g. Grid: Rectangular.
 - h. Main Bars: 1 inch by 1/8 inch.
 - i. Cross Bars: Round, 3/16-inch diameter.
 - j. Spacing, Center-to-Center:
 - 1) Main Bars: 2-7/16 inches.
 - 2) Cross Bars: 5-3/16 inches.
 - k. Weight: 2.2 pounds per square foot.
 - l. Recycled Content: 20 percent.

2.7 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 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- E. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
- F. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- G. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- H. Epoxy Intermediate Coat: Complying with MPI #77 and compatible with primer and topcoat.
- I. Polyurethane Topcoat: Complying with MPI #72 and compatible with undercoat.
- J. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- K. 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.

2.8 FABRICATION

- A. 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.
- B. Shop assemble railings 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.
- C. 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.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded connections unless otherwise indicated.
- H. 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.
- I. Form Changes in Direction as Follows:
 - 1. As detailed.
- J. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- K. Provide inserts and other anchorage devices for connecting railings to concrete work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- L. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Provide toe boards at railings along accessible ramps and landings or as indicated on drawings. Fabricate to dimensions and details indicated.

2.9 STEEL AND IRON FINISHES

- A. Galvanized Railings:
 - 1. Hot-dip galvanize exterior and interior steel 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. Fill vent and drain holes that are exposed in the finish work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
 5. For galvanized railings provide hot-dip galvanized fittings, brackets and fasteners, sleeves and other ferrous components.
- B. 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.
- C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
- 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. Do not apply primer to galvanized surfaces.

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 are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

- A. 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 are 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.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.

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 are inserted into sleeves, fill annular space between post and sleeve with anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
- 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.

3.5 ATTACHING RAILINGS

- A. Attach railings to wall with wall brackets, except where end flanges are used. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- B. Secure wall brackets and railing end flanges to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For hollow masonry anchorage, use toggle bolts.
 - 3. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
 - 4. For steel-framed partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members.
 - 5. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.
 - 6. For steel-framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.6 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 requirements 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.

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 061000 ROUGH CARPENTRY

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. Wood blocking and nailers.
 - 2. Plywood backing panels.

1.3 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions 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.
 - 2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Certified Wood: Materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, FSC Principles and Criteria for Forest Stewardship.
 - 1. Miscellaneous lumber.

- B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 - 3. Provide dressed lumber, S4S, unless otherwise indicated.
- C. Maximum Moisture Content of Lumber: 15 percent unless otherwise indicated.

2.2 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
- B. For items of dimension lumber size, provide Douglas Fir No. 2 grade.
- C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.3 FIRE RATED PLYWOOD

- A. DOC PS 1, Exterior, AC Exterior, C-C Plugged Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.
 - 1. Plywood shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 FIRE RETARDANT TREATMENT

- A. Manufacturer: Hoover or equal.
- B. Treatment Series: Exterior Fire-X.
- C. Ratings:
 - 1. Flame Spread: Maximum flame spread of 25 per ASTM E 84.
 - 2. Labeling: Underwriter Laboratory Listed and Labeled.

2.5 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.

- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1.
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
 - 2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

2.6 MISCELLANEOUS MATERIALS

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

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- B. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.
- C. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- D. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.10.1, "Fastening Schedule," in California Building Code.
 - 3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
- E. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD GROUND, SLEEPER, BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Where wood-preserved-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- D. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 PROTECTION

- A. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes sufficiently wet that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 062023
INTERIOR FINISH CARPENTRY

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. Wall mounted backpack rack system.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.
- B. Samples for Initial Selection: For each type of product involving selection of colors, profiles, or textures.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. 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.

1.5 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 BACKPACK RACK SYSTEM

- A. Manufacturers: Subject to compliance with requirements, provide one of the following products:
 - 1. HangSafe Hooks; 165 E. Hwy CC Nixa, MO, (417) 725-8900, sales@hangsafehooks.com
 - 2. Or equal.
- B. Materials:
 - 1. Hooks: polycarbonate plastic (rounded ends, eased edges, polished), mounted w/ #14 x 2" stainless steel Philips oval head screws & finishing washers.

2. Mounting Board: solid oak wood (1 9/16" ± x 3 1/2" ±) finished with - stain per 09 93 00 "Staining and Transparent Finishing", color ebony.
3. Hook spacing: 5 1/3 inch.

2.2 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.

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. Locate solid webs in studs in framed walls.
- C. Install racks level, with mounting screws or mounting system (provided per the wall type) and 1/4" flat washers in the 3/4" diameter mounting pockets. Tighten screws/bolts to eliminate all movement in rack system.
- D. Glue oak wood finishing button in mounting pocket.

3.4 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.

3.5 CLEANING

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

3.6 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 064116 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

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. Plastic-laminate-faced architectural cabinets.
 - 2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - 2. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural plastic-laminate cabinets.
 - 3. Apply WI Certified Compliance Program label to Shop Drawings.
- C. Samples for Initial Selection:
 - 1. Plastic laminates.
 - 2. PVC edge material.
- D. Samples for Verification:
- E. 1. Plastic laminates, 12 by 12 inches, for each type, color, pattern, and surface finish, with one sample applied to core material and specified edge material applied to one edge.
- F. 2. Wood-grain plastic laminates, 12 by 24 inches, for each type, pattern and surface finish, with one sample applied to core material and specified edge material applied to one edge.
- G. 3. Corner pieces as follows:
- H. a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
- I. b. Miter joints for standing trim.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator / installer.
- B. Product Certificates: For the following:
 - 1. Composite wood and agrifiber products.
 - 2. High-pressure decorative laminate.
 - 3. Adhesives.

- C. Woodwork Quality Standard Compliance Certificates: WI Certified Compliance Program certificates.

1.5 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. Shop is a licensee of WI's Certified Compliance Program.
- B. Installer Qualifications: Licensee of WI's Certified Compliance Program.
- C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Provide full size base cabinet, upper cabinet and each counter type, in specified finish with hardware installed.
 - 2. Build mockups of typical plastic-laminate cabinets as shown on Drawings.
 - 3. 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. 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.
- C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

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.

1.1 REGULATORY REQUIREMENTS

- B. Operable parts for all accessible casework shall comply with CBC Section 11B-309.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL CABINET FABRICATORS

- A. Basis of Design: Characteristics of specific products, where named in this section, are indicated to establish required level of quality, appearance and performance.

2.2 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. Casework Cores: Provide SierraPine Arreis or equal, phone (503) 773-2522, Medium Density Fiberboard (MDF), Type MD, Per ANSI A 208.2, latest edition and NEMA LD3-85.
 - 1. Provide Scientific Certification System certification that product is manufactured from 100 percent recovered and recycled wood fiber content and contains no added formaldehyde.
- E. Cabinet Door Cores: Provide SierraPine Arreis or equal, phone (503) 773-2522, Medium Density Fiberboard (MDF), Type MD, Per ANSI A 208.2, latest edition and NEMA LD3-85.
 - 1. Provide Scientific Certification System certification that product is manufactured from 100 percent recovered and recycled wood fiber content and contains no added formaldehyde.
- F. Shelving: Provide SierraPine Arries or equal, phone (503) 773-2522, Medium Density Fiberboard (MDF), Type MD, Per ANSI A 208.2, latest edition and NEMA LD3-85.
 - 1. Provide Scientific Certification System certification that product is manufactured from 100 percent recovered and recycled wood fiber content and contains no added formaldehyde.
 - 2. Provide 1 inch thick shelving at spans in excess of 36 inches.
- G. Countertop Cores: provide SierraPine Medex or equal, phone (503) 773-2522, Medium density Fiberboard (MDF), Type MD - Exterior, per ANSI A 208.2, latest edition and NEMA LD3-85, 3/4 inch thick minimum, formed as shown on drawings for specific edge.
- H. Provide Scientific Certification System certification that product is manufactured from 100 percent recovered and recycled wood fiber content and contains no added formaldehyde.
- I. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.
- J. Reveal Dimension: 1/2 inch.
- K. 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 by one of the following:
 - a. Formica Corporation.
 - b. Lamin-Art, Inc.
 - c. Panolam Industries International, Inc.

- d. Wilsonart International; Div. of Premark International, Inc.
- L. Laminate Cladding for Exposed Surfaces:
 - 1. Horizontal Surfaces: Grade HGS.
 - 2. Postformed Surfaces: Grade HGP.
 - 3. Vertical Surfaces: Grade VGS.
 - 4. Edges: PVC edge banding, 0.12 inch thick, matching laminate in color, pattern, and finish.
 - 5. Pattern Direction: Horizontally for drawer fronts, doors, and fixed panels.
- M. Materials for Semiexposed Surfaces:
 - 1. Surfaces Other Than Drawer Bodies: Panolam Thermofused melamine WI listed.
 - a. Edges of Plastic-Laminate Shelves: PVC edge banding, 0.12 inch thick, matching laminate in color, pattern, and finish.
 - b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide Panolam Thermofused melamine WI listed.
 - 2. Drawer Sides and Backs: Provide SierraPine Arreis or equal, Medium density Fiberboard (MDF), Type MD, per ANSI A 208.2, latest edition and NEMA LD3-85.
 - 3. Drawer Bottoms: Provide SierraPine Arries or equal, Medium density Fiberboard (MDF), Type MD, per ANSI A 208.2, latest edition and NEMA LD3-85.
- N. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
- O. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
 - 1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.
- P. 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 selected by Architect from full color and finish line for specified products.
 - a. Face: (PL-1)
 - b. Countertop: (PL-2)
 - c. Accent: (PL-3)
 - d. Accent: (PL-4)
- Q. 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: 4 to 9 percent.
- R. Wood Trim:
 - 1. Species: Maple
 - 2. Grade/cut: Premium, per WI, Section 3, Table 3.2, quarter sawn.
 - 3. Moisture Content: Maximum 12%, minimum 6%.
 - 4. Finish: Factory prefinished transparent, WI System 2, over sanding filler and gel stain as selected by Architect.
- S. 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.
 - 2. 1. Softwood Plywood: DOC PS 1.

3. 2. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.

T. Surface Finish Criteria

1. Exposed portions: Finish exposed portions with high pressure laminate as specified. For purposes of this specification, definition of exposed portions requiring high pressure laminate includes:
 - a. Interior surfaces of knee space or recesses provided for moveable equipment.
 - b. Tops of cabinets with more than 18 inches clear between the ceiling and cabinet.
 - c. Bottom of wall hung cabinets.
 - d. All cabinet doors and surfaces.
 - e. All drawers front surfaces.
 - f. Slopped tops.
2. Filler Panels: Provide filler panels as required to accommodate door and drawer function. Unless noted otherwise, provide 2 inch dimension as wall conditions, and 4 inch dimensions at inside, cabinet to cabinet corner conditions.

2.3 CABINET HARDWARE AND ACCESSORIES

- A. Provide in accordance with Resource Guide Appendix to WI Manual of Millwork except as noted below.
- B. Hinges: Unless noted otherwise, provide RPC or equal, 850 or 370 series, Heavy duty wrap around, Hospital Tips, 2-3/4 inch height minimum, width configuration as required for application, color as selected by Architect from complete line, including powder coating.
- C. Drawer and Door Pulls: Trimco or equal, loop handle, 4 inch center to center, No. 562-4 inches x US 26D.
- D. Adjustable Shelf Standards and Supports: Provide KV 346, ENG11-WH or equal metal shelf support clips, with Phillips PHWS at each clip.
 1. Drawer Guides: Unless noted otherwise, provide Accuride Model 3832 at drawers less than 24 inches wide, Model 4034 at drawers 24 inches and wider and file locations.
 2. File Drawers: Provide Pendaflex G-6110-04(WH) file railing system at all drawers marked "file".
- E. Door and Drawer Locks:
 1. Manufacturer: Olympus, www.olympus-lock.com, as represented by Coffman Associates, phone (626) 810-7337.
 2. Type: Provide specified design, with front loaded removable cylinder permitting rekeying without total lock disassembly.
 - a. Drawer Lock Series: 800SC, pin tumbler design, suitable for Owners standard keyway, with bar strike. Comply with ANSI A156.11 Grade 1 cycle testing criteria.
 - b. Door Lock Series: 700SC, pin tumbler design, suitable for Owners standard keyway, with bar strike. Comply with ANSI A156.11 Grade 1 cycle testing criteria.
 - c. Sliding Door Lock Series: 400SD, pin tumbler design, plunger lock with built in bolt extender, with strike, suitable for Owners standard keyway.
 - d. Cam Lock Series: CR1,2,3,and 4, 600DW, with working top slide and retainer staple, suitable for Owners standard keyway.
 - e. Finish: US 26D.
 - f. Keying: Key to Owners standard keyway . Key alike all locks within each room, and key each room differently.

- g. Accessory: Provide Ives IV2A or equal elbow catch at inactive cabinet door leaf.
- 3. Magnetic catches: Provide magnetic catches at all cabinet doors, with maximum 5 pounds holding power.

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 for Bonding Plastic Laminate: Contact cement.
- D. 1. Adhesive for Bonding Edges: Hot-melt adhesive.

2.5 FABRICATION

- A. Construct casework to WI Premium grade, modified as specified in this section.
 - 1. Provide white anchor screw cover caps.
 - 2. Fabricate all drawers full depth of cabinet.
 - 3. Provide cabinet locks at the following locations:
 - a. At all teacher workrooms, office areas, administrative areas, health areas, and 25% of all other areas per Owner direction
 - 4. Construct countertops conforming to WI Premium grade.
 - a. Provide wood edge trim as shown on drawings unless specified otherwise.
 - 1) Species: Maple.
 - 2) Grade/cut: Premium, per WI, Section 3, Table 3.2, quarter sawn.
 - 3) Moisture Content: Maximum 12%, minimum 6%.
 - 4) Finish: Factory prefinished transparent, WI System 2, over sanding filler and gel stain as selected by Architect.
 - b. At wet area conditions, such as toilet room countertops, provide waterfall splash top edge, coved back splash and rolled front edge. Where end splash are required, butt waterfall splash portion into end splash.
 - c. Where self-edged countertops are shown, extend top laminate over front edge laminate per Premium Grade criteria.
- B. Provide WI listed backer sheet.
- C. Fabricate cabinets to dimensions, profiles, and details indicated.
- D. 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.
- E. Plough drawer bottoms into sides, fronts, or sub fronts, and backs. Surface attachment of bottoms is not acceptable.
- F. Install paper management grommet and wire grommet at each countertop, located as directed by Architect.

- G. Install door and drawer handle horizontally, spaced as shown on drawings. Do not center drawer handles in drawer face. Space same distance from top edge of drawer as at doors.
- H. 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.
- B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.
- C. Verify adequacy of backing support framing.

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.
- 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. Set and secure casework in accordance with WI Manual of Millwork and T - 24 CCR Provide WI Certified Compliance Certificate for Installation.
 - 3. Install separate anchor strips behind cabinet back. Cabinet back shall not be used for anchorage.
 - a. Provide one anchor strip top and bottom for wall hung cabinets and base cabinets less than four feet high. Provide three strips for base cabinets over four feet high.
 - b. Provide design and detailing for seismic attachment/bracing of all free standing library shelving units, including specifying and coordinating all required embedded shields necessary to comply with DSA requirements.
 - 4. 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. Adjust doors with mechanical and magnetic catches to limit opening force to maximum 5 pounds force.
- C. Clean, lubricate, and adjust hardware.
- D. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION 064116

SECTION 071326 - SELF-ADHERING SHEET WATERPROOFING

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. Modified bituminous sheet waterproofing.
 - 2. Prefabricated Drainage Protection Board System

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
 - 2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.
- B. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
- C. Samples: For each exposed product and for each color and texture specified, including the following products:
 - 1. 8-by-8-inch square of waterproofing and flashing sheet.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Warranties.

1.5 QUALITY ASSURANCE

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

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
 - 1. Do not apply waterproofing in snow, rain, fog, or mist.
- B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.7 WARRANTY

- A. Manufacturer's Warranty: Manufacturer's standard materials-only warranty in which manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.

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

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Source Limitations for Waterproofing System: Obtain waterproofing materials from single source from single manufacturer.

2.2 MODIFIED BITUMINOUS SHEET WATERPROOFING

- A. Modified Bituminous Sheet: Minimum 60-mil nominal thickness, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated on one side to a 4-mil- thick, polyethylene-film reinforcement, and with release liner on adhesive side; formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.
 1. Products: Subject to compliance with requirements, provide the following:
 - a. Grace, W. R., & Co.; Bituthene 4000.
 - b. WR Meadows; Mel-Rol.
 - c. MAPEI; Mapethene HT.
 - d. or Equal.
 2. Physical Properties:
 - a. Tensile Strength, Membrane: 250 psi minimum; ASTM D 412, Die C, modified.
 - b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
 - c. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970.
 - d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836.
 - e. Puncture Resistance: 40 lbf minimum; ASTM E 154.
 - f. Water Absorption: 0.2 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
 - g. Water Vapor Permeance: 0.05 perms maximum; ASTM E 96/E 96M, Water Method.
 - h. Hydrostatic-Head Resistance: 200 feet minimum; ASTM D 5385.

2.3 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
 1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Primer: Liquid waterborne primer recommended for substrate by sheet-waterproofing material manufacturer.
- C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by sheet-waterproofing material manufacturer.
- D. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch thick, predrilled at 9-inch centers.

2.4 DECK WATERPROOFING SYSTEM

1. Products: Subject to compliance with requirements, provide the following:
 - a. Hydro Duct 660 Drainage composite by Grace Construction Products
 - b. WR Meadows Mel-Prime with Mel-Rol with Mel Drain 5035.
 - c. MAPEI Mapedrain 20; Mapedrain 40.

- d. or Equal.

2.5 PREFABRICATED DRAINAGE BOARD SYSTEM

- A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Composite subsurface drainage panel consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 sieve laminated to one side of the core and a polymeric film bonded to the other side; and with a vertical flow rate of 9 to 15 gpm per ft..
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Carlisle Coatings & Waterproofing Inc.; CCW MiraDRAIN 6000.
 - b. Grace, W. R., & Co. - Conn.; Hydroduct 600.
 - c. WR Meadows 5012 Drain Board.
 - d. MAPEI Mapedrain 20.
 - e. or Equal.

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 waterproofing.
 - 1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
 - 2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
- E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
 - 1. Install sheet strips of width according to manufacturer's written instructions and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch.
- F. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
 - 1. Install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners and as follows:
 - a. At footing-to-wall intersections, extend liquid membrane in each direction from corner or install membrane strip centered over corner.

- G. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.3 MODIFIED BITUMINOUS SHEET-WATERPROOFING APPLICATION

- A. Install modified bituminous sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D 6135.
- B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure watertight installation.
 - 1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.
- D. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.
- E. Seal edges of sheet-waterproofing terminations with mastic.
- F. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches beyond repaired areas in all directions.
- G. Immediately install protection course with butted joints over waterproofing membrane.
- H. Retain first paragraph below if terminating into other waterproofing.
- I. Repair tears, voids, and lapped seams in waterproofing that do not comply with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches beyond repaired areas in all directions.

3.4 PREFABRICATED DRAINAGE BOARD SYSTEM INSTALLATION

- A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, according to manufacturer's written instructions. Use adhesives or other methods that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.
- B. Place and secure universal outlets at each end of the system and connector tees at 100 foot intervals, connect all outlets to the nearest storm drain.

3.5 PROTECTION, REPAIR, AND CLEANING

- A. Protect waterproofing from damage and wear during remainder of construction period.
- B. Protect installed from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

- D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 071326

SECTION 071353 - ELASTOMERIC SHEET WATERPROOFING

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. Faced elastomeric flashing for use at sill, head and jamb at openings, sloped plaster surfaces, under copings and locations per drawings.

1.3 PREINSTALLATION MEETINGS

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
 - 2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.
- B. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
- C. Samples: For each exposed product and for each color and texture specified, including the following products:
 - 1. 8-by-8-inch square of waterproofing and flashing sheet.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.6 QUALITY ASSURANCE

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

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
 - 1. Do not apply waterproofing in snow, rain, fog, or mist.
- B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.8 WARRANTY

- A. Manufacturer's Warranty: Manufacturer's standard materials-only warranty in which manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Source Limitations for Waterproofing System: Obtain waterproofing materials from single source from single manufacturer.

2.2 ELASTOMERIC SHEET WATERPROOFING

- A. Rubberized asphalt Sheet: Minimum 40-mil nominal thickness, self-adhering sheet, 18 to 36 inch wide.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. MFM Building Products.
 - b. Carlisle Coatings & Waterproofing Inc.
 - c. Grace Construction Products; W.R. Grace & Co. -- Conn.
 - d. Or Equal.
 2. Physical Properties:
 - a. Tensile Strength, Membrane: 250 psi minimum; ASTM D 412, Die C, modified.
 - b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
 - c. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970.
 - d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836.
 - e. Puncture Resistance: 40 lbf minimum; ASTM E 154.
 - f. Water Absorption: 0.2 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
 - g. Water Vapor Permeance: 0.05 perms maximum; ASTM E 96/E 96M, Water Method.
 - h. Hydrostatic-Head Resistance: 200 feet minimum; ASTM D 5385.

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 waterproofing.
 1. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
- E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
- F. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions.

3.3 FULLY ADHERED SHEET INSTALLATION

- A. Install fully adhered sheets over entire area to receive waterproofing according to manufacturer's written instructions and recommendations in ASTM D 5843.
- B. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required. Stagger end laps.
- C. Apply bonding adhesive to substrates at required rate and allow it to partially dry.
- D. Apply bonding adhesive to sheets and firmly adhere sheets to substrates. Do not apply bonding adhesive to splice area of sheet.
- E. Install fully adhered sheets and auxiliary materials to tie into existing waterproofing.
- F. Repair tears, voids, and lapped seams in waterproofing that do not comply with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending beyond repaired areas in all directions.
- G. Horizontal Application: Apply sheets with side laps shingled with slope of deck where possible.

3.4 SHEET-FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to waterproofing manufacturer's written instructions.
- B. Form wall flashings using exposed sheet flashing.
- C. Extend deck sheet waterproofing to form wall flashings.
 - 1. Flash penetrations and field-formed inside and outside corners with uncured sheet flashing.

3.5 PROTECTION, REPAIR, AND CLEANING

- A. Protect installed from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- B. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.
- C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 071353

SECTION 071900 - WATER REPELLENTS

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 penetrating film-forming MPI-approved water-repellent treatments for the following vertical and horizontal surfaces:
 - 1. Cast-in-place concrete.
 - 2. Concrete unit masonry.

1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Water repellents shall meet performance requirements indicated without failure due to defective manufacture, fabrication, or installation.
 - 1. Cast-in Place Concrete: ASTM C 642.
 - 2. Concrete Masonry Units: ASTM C 140.

1.4 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.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Applicator.
- B. Product Certificates: For each type of water repellent, from manufacturer.

1.6 QUALITY ASSURANCE

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

1.7 PROJECT CONDITIONS

- A. Limitations: Proceed with application only when the following existing and forecasted weather and substrate conditions permit water repellents to be applied according to manufacturers' written instructions and warranty requirements:
 - 1. 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. Substrate is not frozen and substrate-surface temperature is above 40 deg F and below 100 deg F.
 - 5. Rain or snow is not predicted within 24 hours.
 - 6. Not less than seven days have passed since surfaces were last wet.
 - 7. Windy conditions do not exist that might cause water repellent to be blown onto vegetation or surfaces not intended to be treated.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agree(s) to repair or replace materials that fail to maintain water repellency specified in "Performance Requirements" Article within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PENETRATING WATER REPELLENTS

- A. Silane, Penetrating Water Repellent: Clear, containing 20 percent or more solids of alkyltrialkoxysilanes; with alcohol, mineral spirits, water, or other proprietary solvent carrier; and with 100 g/L or less of VOCs per South Coast Air Quality Management District requirements
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Tnemec Inc., Series 633 Prime-A-Pell H20.
 - b. Degussa Corp; Protectosil Aqua-Trete 20.
 - c. Prosoco, Sure Klean Weather Seal, Siloxane WB Concentrate.
 - d. Hydrozo Enviroseal Double 7 Block or equal, VOC compliant water repellent coating at all concrete exterior surfaces.
 - e. or Equal.

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 water-repellent manufacturer's requirements. Check moisture content in three representative locations by method recommended by manufacturer.
 - 2. Inspect for previously applied treatments that may inhibit penetration or performance of water repellents.
 - 3. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.
 - 4. Verify that required repairs are complete, cured, and dry before applying water repellent.
- B. Test pH level according to water-repellent manufacturer's written instructions to ensure chemical bond to silica-containing or siliceous minerals.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Cleaning: Before application of water repellent, clean substrate of substances that could impair penetration or performance of product according to water-repellent manufacturer's written instructions and as follows:
 - 1. Cast-in-Place Concrete and Concrete Unit Masonry: Remove oil, curing compounds, laitance, and other substances that inhibit penetration or performance of water repellents according to ASTM E 1857.

- B. Protect adjoining work, including mortar and sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live vegetation.
- C. Coordination with Sealant Joints: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.
 - 1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those required.

3.3 APPLICATION

- A. 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. Apply coating in dual passes of uniform, overlapping strokes. Remove excess material; do not allow material to puddle beyond saturation. Comply with manufacturer's written instructions for application procedure unless otherwise indicated.

3.4 CLEANING

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

END OF SECTION 071900

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Glass-fiber blanket insulation for exterior wall construction.
 - 2. Acoustical insulation for interior wall construction.
 - 3. Theater acoustical insulation system.
 - 4. Reflective insulation.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each product, for tests performed by a qualified 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 THERMAL INSULATION: EXTERIOR WALL

Glass-Fiber Blanket, Reinforced-Foil Faced: ASTM C 665, Type III (reflective faced), Class A (faced surface with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics

- A.); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Owens Corning.
 - d. Or Equal.
 - 2. Type: Foil-Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type III (reflective faced), Class B (faced surface with a flame-propagation resistance of 0.12 W/sq. cm); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.
 - 3. Construction:
 - a. Walls and vertical locations: FSK-25 Faced, R-19, 6 1/2 inch.
 - b. Roofs and horizontal locations: FSK-25 Faced, R-30, 10 1/4 inch.
 - 4. Sustainability Requirements: Provide glass-fiber blanket insulation as follows:

- a. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.
- b. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde.
- c. Recycled Content: Minimum 30 percent total recycled content, with minimum 30 percent post-consumer recycled content.

2.2 ACOUSTICAL INSULATION: INTERIOR WALL

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. CertainTeed Corporation.
 - 2. Johns Manville; a Berkshire Hathaway company.
 - 3. Owens Corning.
 - 4. Or Equal.
- B. Type: Sound Control Glass fiber batt, friction fit, unfaced.
- C. Construction:
 - 1. Blanket: Glass Fiber, Type 1 per ASTM c 665
 - 2. Thickness: 3 5/8 inch.
 - 3. Facing: None.
- D. Sustainability Requirements: Provide glass-fiber blanket insulation as follows:
 - 1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.
 - 2. Recycled Content: Minimum 30 percent total recycled content, with minimum 30 percent post-consumer recycled content.
- E. Fire/Habitability Criteria:
 - 1. Flame Spread Classification: Maximum 25 per ASTM E 84.
 - 2. Smoke Developed Classification: Maximum of 50 per ASTM E 84.
 - 3. Perm Rating (foil facer): Maximum 0.02 grains/hr/sf/in Hg per ASTM C 665.

2.3 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AGM Industries, Inc.
 - b. Cal-Fasteners, Inc.
 - c. Integrity Fasteners, Inc.
 - d. Or Equal.
 - 2. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - 3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.
- B. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. AGM Industries, Inc.

- b. Cal-Fasteners, Inc.
 - c. Integrity Fasteners, Inc.
 - d. Or Equal.
 - 2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
 - a. Crawl spaces.
 - b. Ceiling plenums.
 - c. Attic spaces.
 - C. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AGM Industries, Inc.
 - b. Cal-Fasteners, Inc.
 - c. Gemco.
 - d. Or Equal.
- 2.4 ACCESSORIES
- A. Insulation for Miscellaneous Voids:
 - 1. Glass-Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.
 - B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or 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.
- 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. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. 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 and support faced blankets by taping flanges of insulation to flanges of metal studs.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.
- 3.4 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 074113 - STANDING-SEAM METAL ROOF PANELS

PART 1 - GENERAL

1.1 SECTION INCLUDES:

- A. Preformed, prefinished metal roof panels.
- B. Curved, preformed, prefinished metal roof panels.
- C. Accessory products
- D. Underlayment
- E. Rigid board insulation

1.2 REFERENCES

- A. AISI - Specification for the Design of Cold-Formed Steel Structural Members.
- B. ASTM A36 - Standard Specification For Carbon Structural Steel.
- C. ASTM A 653 –Standard Specification For Steel Sheet, Zinc-Coated (Galvanized) Or Zinc-Iron Alloy-Coated (Galvannealed) By The Hot-Dip Process. .
- D. ASTM A 792 – Standard Specification For Steel Sheet, 55% Aluminum-Zinc Alloy-Coated By The Hot-Dip Process.
- E. AWS D1.1 - Structural Welding Code.
- F. CBC Chapter 15, Part 2, Title 24.
- G. ICBO Report 4607, Table V1.
- H. Underwriters Laboratories Roofing Materials and Systems Directory.

1.3 RELATED DOCUMENTS

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

1.4 SUMMARY

- A. This Section includes the following:
- B. Related Sections include the following:
 - 1. Division X Section "" for .

1.5 ACTION SUBMITTALS

- A. Submit under provisions of Section 013300.
- B. Shop Drawings:
 - 1. Submit shop drawings that indicate thickness and dimensions of panels, fastening methods, details and location of laps and joints, transitions and other provisions necessary to provide a weather-tight installation.
 - 2. Indicate roof terminations, clearly showing flashings, valleys, ridge caps and hip caps.
 - 3. Indicate locations of field applied sealant.
 - 4. Indicate type and spacing of fasteners.
 - 5. Provide layout plan of entire metal roof surfaces.

- C. Samples:
 - 1. Submit two samples 12" long x full width of panel indicating gauge, profile and each finish.
- D. Engineering Calculations: Submit engineering for all roof panels, clips, and fasteners demonstrating compliance with specified criteria. Calculations shall be signed by a registered engineer licensed in California.
- E. Product Data: For each type of door and frame indicated. Include construction details relative to materials, individual components and profiles, finishes, and fire ratings (if required) for access doors and frames.
- F. Shop Drawings: Show fabrication and installation details of customized doors and frames. Include plans, elevations, sections, details, and attachments to other Work.
- G. Samples: For each door face material, at least 3 by 5 inches in size, in specified finish.
- H. Schedule: Provide complete door and frame schedule, including types, general locations, sizes, construction details, latching or locking provisions, and other data pertinent to installation.
- I. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items with concealed framing, suspension systems, piping, ductwork, and other construction. Show the following:
 - 1. Method of attaching door frames to surrounding construction.
 - 2. Ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For each type of
- B. Product Certificates:
- C. Field quality-control reports.

1.7 QUALIFICATIONS

- A. Installer: Company specializing in performing the work of this Section with minimum 5 years documented experience.
- B. Manufacturer shall have produced the specified products for a period of 10 years prior to beginning work of this section, and shall have the capability to produce the specified products to the delivery and quantity criteria of the project.

1.8 PRE-INSTALLATION CONFERENCE

- A. Convene a pre-installation conference one week prior to commencing work of this Section. Provide minimum 2 weeks advance notice to Owner and Architect of scheduled date. Comply with provisions of Section 013100. Attendance by material manufacturer's representative is mandatory.
- B. Review installation procedures and coordination required with related work. Coordinate requirements to ensure insulation/roof panel fasteners fall within upper flute bearing surface of metal deck. Exposed fasteners not permitted.

1.9 DESIGN CRITERIA

- A. Roof System Design Requirements:

1. The structural performance test methods and requirements of the Standing Seam Roofing Systems (SSRS) shall be in accordance with ASTM E1592.
- 2.
3. Provide Roof System suitable for installation over rigid board insulation substrate.
4. Provide Roof System suitable for installation over solid plywood sheathing.
5. Where plywood sheathing does not conform to specific wind uplift test data, increase fastener spacing as required to achieve UL90 resistance values.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Section 016000.
- B. Store and protect products under provisions of Section 016000.
- C. Cut plastic wrap to encourage ventilation.
- D. Separate sheets and store decking on dry wood sleepers; slope for positive drainage.
- E. Handle all roof panels in manufacturer approved fashion. Do not cause panel to be buckled or compressed.

1.11 FIELD MEASUREMENTS

- A. Verify that field measurements are as shown on Drawings.

1.12 GUARANTEE AND WARRANTY

- A. Contractor's Guarantee
 1. Provide Owner with written Guarantee on Contractor's letterhead, and signed by General Contractor and roofing system installer.
 2. Provide guarantee for a time period of five years, commencing from the date of final acceptance of the project, against the following defects:
 - a. Water penetration through metal roof assembly, including flashings, resulting from improper installation or material defects.
 3. Make inspections and emergency repairs to defects or leaks in the roof system within twenty-four (24) hours of receipt of notice from the Owner.
 4. Restore the affected areas to the standard of the original specifications as soon as weather permits.
- B. Manufacturers Weathertight Guarantee:
 1. Furnish manufacturer's standard materials and workmanship warranty for the roofing system.
 2. The warranty period shall be not less than Twenty (20) years from the date of acceptance of the work.
 3. The warranty shall be issued directly to the Owner.
 4. The warranty shall provide that if within the warranty period the metal roofing system becomes non-watertight or shows evidence of corrosion, perforation, rupture or excess weathering due to deterioration of the roofing system resulting from defective materials or installed workmanship the repair or replacement of the defective materials and correction of the defective workmanship shall be the responsibility of the roofing system manufacturer.
 5. The Contractor shall also provide a 2 year contractor installation warranty.
 6. Provide Owner with metal roofing system manufacturers written guarantee complying with the following criteria:

- a. Type: Guarantee for labor and material necessary to maintain roof system in a watertight and weathertight condition.
 - b. Term: Ten (10) years minimum.
 - c. Scope: All metal roof system components, including flashings and sealants.
- C. Manufacturers Color Guarantee:
 - 1. Provide Owner with metal roofing system manufacturers written guarantee against coating system failure complying with the following criteria:
 - a. Type: Guarantee against coating failure of metal panels and components.
 - b. Term: Thirty (30) years minimum.
 - c. Twenty (20) years minimum.
 - d. Scope: All metal roof system components, including flashings.
- 1.13 CLOSEOUT SUBMITTALS
 - A. Maintenance Data: 1 maintenance manuals.
- 1.14 MAINTENANCE MATERIAL SUBMITTALS
 - A. Furnish extra materials1
- 1.15 QUALITY ASSURANCE
 - A. Source Limitations: Obtain doors and frames through one source from a single manufacturer.
 - B. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are labeled and listed by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. NFPA 252orUL 10B for vertical access doors.
 - 2. ASTM E 119orUL 263 for horizontal access doors and frames.
 - C. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.
- 1.16 COORDINATION
 - A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.1 METAL ROOFING PANELS

- A. Basis of Design: Characteristics of specific products manufactured by AEP-SPAN www.aepspan.com are indicated to establish required level of quality, appearance, and performance. The Architect will consider requests for substitutions, under the provisions of Section 012500.
 - 1. Drawings and specifications indicate sizes, profiles, colors, and dimensional requirements, and are based upon the specific products indicated in this Section. Do not modify intended aesthetic effect, as judged solely by the Architect, except with Architect's approval and only to the extent needed to comply with performance requirements and to match existing conditions. Submit comprehensive explanatory data to Architect for review where modifications are proposed.
- B. Series: DesignSpan HP, standing seam roof panel.

- C. Construction:
 - 1. Panel Depth: 1-3/4 inch standing rib.
 - 2. Panel Face Width: 18 inch.
 - 3. Gauge: 22 gage.
 - 4. Base Metal: Prepainted Galvalume Sheet, 50 ksi per ASTM A 792.
 - 5. Weather seal: Factory installed sealant at panel edge.
- D. Design Values:
 - 1. The structural performance test methods and requirements of the Standing Seam Roofing Systems (SSRS) shall be in accordance with ASTM E1592.
 - 2. 365/366 at metal decking with rigid board insulation.
 - 3. Wind Rating: UL 90 per UL 580, listed per UL Construction 364 at plywood deck.
 - 4. Fire Rated Assembly: Listed as a component in a one rated roof assembly at gymnasium building.
 - 5. Finish/Color:
 - a. Finish: Dura Tech 5000 - Premium 70% Fluoropolymer (PVDF) Coating.
 - b. Color: Manufacturers standard color line of colors, "Cool Walnut". Provide barrier and/or clear coats as required.
 - c. Panel Back: Manufacturer's standard finish.
- E. Accessories:
 - 1. Flashings: Provide PVDF prefinished flashings, in material and color matching roof panel, as necessary to provide transitions, closures, and waterproofing.
 - a. Provide stretch-formed prefinished aluminum flashings at all radiused conditions.
 - 2. Fasteners: Provide sheet metal fasteners, non-magnetic, color matched where exposed, of length, head, and point type appropriate to fastening method, with neoprene washers.
 - 3. Clip: Provide UL 90 rated clip, with non-magnetic, fasteners. Clip shall be designed to permit expansion and contraction of roofing system, as well as raise panel above substrate for underpanel ventilation.
 - 4. Sealants: Type 1 or 2 sealant as required by movement conditions as specified in Section 079200.
 - 5. End cap: manufacturers standard, color Cool Walnut.
 - 6. Additional products: Provide additional clips, hooks, closures, and related components as recommended by manufacturer.

2.2 UNDERLAYMENT

- A. Provide elastomeric flashing as specified in Section 071353.
 - 1. Underlayment not acceptable for curved applications Ó Use Ice and water Shield Ó verify w/rep

2.3 WATERPROOF MEMBRANE UNDERLAYMENT

- A. Manufacturer: Grace Construction Products www.na.graceconstruction.com, or equal.
- B. Type: Rubberized Asphalt, with polyethylene film facer.
- C. Series: Grace Ultra.
- D. Characteristics:
 - 1. Thickness: 0.030 inches (30 mils).
 - 2. Tensile Strength: 250 psi.
 - 3. Permeance: 0.05 grains/SF/in Hg per ASTM E 96, Method B.
 - 4. Adhesion to plywood: 3.0 pounds/in width.

5. High temperature application, 300F resistance, extended period
- E. Accessories:
 1. Provide all required primers, detailing materials, sealants and reinforcing membranes required for complete installation.
- 2.4 ROOFING BOARD
 - A. Products: Subject to compliance with requirements, provide the following:
 1. Georgia-Pacific Corporation: Dens Deck.
 - B. Characteristics: Roofing Board to comply with ASTM C 1289, glass-mat, water-resistant gypsum substrate,
 1. Thickness: 1/4 inch thick.
- 2.5 RIGID BOARD INSULATION
 - A. Polyisocyanurate Rigid Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, HCFC-free with fiber glass reinforced facers on both major surfaces.
 - B. Manufacturer: Johns Manville or equal.
 - C. Series: "Enrgy 3"
 - D. Characteristics:
 1. Thickness: 5.0 inch, single thickness.
 2. Fire Rating: UL Listed and Classified as a part of a Class A listed Roof Assembly.
 3. Fabricate board as necessary to permit installation between fastening clips as shown on drawings.
 - E. Accessory Products:
 1. Purlin: Provide galvanized steel purlin, 16 gage, 50,000 psi minimum yield strength, galvanized to G120 coating class.
 2. Purlin Fasteners: Provide threaded mechanical fastener, fluorocarbon coated, type and size as required to comply with UL approval for anchoring purlin to metal deck.
 3. Insulation Fasteners: Provide fastener as required to comply with roof uplift listing, fluorocarbon finish, length as recommended by manufacturer to penetrate metal deck, with approved backer plate.
 4. "Z" Clip: Provide galvanized steel "Z" clip, 20 gage, galvanized to G120 coating class.
 5. Z-Clip Fasteners: Provide threaded mechanical fastener, fluorocarbon coated, length as recommended by manufacturer to penetrate metal deck.
 6. Insulation Fasteners: Provide Manville Ultrafast system, length as recommended by manufacturer to penetrate metal deck, with plastic backer plate.
- 2.6 FABRICATION
 - A. Provide factory formed panels to profiles specified. On-site edge forming is not permitted.
 - B. Fabricate panels in maximum length acceptable for transportation. Where intermediate seams are required, locate as directed by Architect.
 - C. Radius panels using manufacturers approved forming system, providing continuous smooth leg and pan free of crimps and buckles.
 - D. Terminate panel edges at valley and eave conditions with concealed "S" clip design, fully bedded in sealant. Use of exposed termination clip and heel sealant joint not permitted.

2.7 OTHER MATERIALS

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

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Inspection:
 - 1. Prior to work of this section, carefully inspect previously installed work. Verify all such work is complete to the point where this installation may properly commence.
 - 2. Verify that work of this section may be installed in strict accordance with the original design, all pertinent codes and regulations, and all pertinent portions of the referenced standards.
 - 3. In the event of discrepancy, immediately notify the Architect.
 - 4. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 ROOF DECK INSULATION INSTALLATION- Z CLIP METHOD

- A. Install in accordance with manufacturers recommendations.
- B. Coordinate spacing of "Z" clips to accommodate roof panel installation. Obtain approval of Z-clip layout by metal roofing installer.
- C. Install clips across metal decking flutes, fastened as shown on drawings with specified fastener.
- D. Coordinate spacing of purlins with insulation. Install purlins at right angles to metal decking flutes at 48 inches on center maximum.
- E. Lay insulation boards with edges in contact without forcing or buckling board. Cut insulation neatly around penetrations and to fit against perimeter blocking or clips.
- F. Mechanically fasten insulation to decking with minimum 4 fasteners per board, and as recommended by insulation manufacturer.

3.3 ROOF DECK INSULATION INSTALLATION – DIRECT TO DECKING ATTACHMENT METHOD

- A. Install in accordance with roof panel manufacturers recommendations. Roof panel system anchored to metal decking system through insulation substrate.
- B. Coordinate spacing of insulation with metal deck bearing surface flutes.
- C. Lay insulation boards with edges in contact without forcing or buckling board. Cut insulation neatly around penetrations and to fit against perimeter blocking or clips.
- D. Mechanically fasten insulation to decking with minimum 4 fasteners per board, and as recommended by insulation manufacturer, in coordination with roofing manufacturer clip anchorage criteria.

3.4 ROOFING PANEL INSTALLATION

- A. Comply with manufacturer's recommended installation procedures. Install in accordance with approved shop drawings.

- B. Treat any contacting surfaces of dissimilar metals to prevent electrolytic corrosion.
 - 1.
 - 2. At insulation substrate, verify insulation panels are properly fitted between clips, without gaps, ridges, or scuffs.
 - 3. Provide two layers of underlayment at all plywood decking and insulation substrate surfaces. Lap edges minimum 6 inches.
 - 4. Provide elastomeric flashing at all valleys, flashing transitions and penetrations. Extend 18 inches past transition or as directed by Architect. Shingle lap with underlayment. May be required to install elastomeric flashing as complete underlayment at curved roof applications Ó verify w/mfr
 - 5. Provide elastomeric flashing at all conditions where roof slope is less than 3:12, including ridge and curved roof transitions. Extend 18 inches past transition or as directed by Architect. Shingle lap with underlayment. May be required to install elastomeric flashing as complete underlayment at curved roof applications Ó verify w/mfr
 - 6. Install rosin slip sheet over all underlayment applications.
 - C. Fasten roof system to sheathing or purlin framing with clip and fastener as required to comply with wind load criteria.
 - D. Fasten roof system through roof insulation to metal decking. Align fastener with metal decking bearing surface so that fasteners are concealed. Provide clips and fastener at spacing as required to comply with wind load criteria.
 - E. Cut roofing panels and components neat, square, and true. Torch cutting prohibited. Where cut is exposed to final view or weather, deburr panel edges where saw cut. Coat concealed cut edges with cold galvanizing compound. Hem all cut edges exposed to final view.
 - F. Field apply sealant to penetrations, transitions, and other locations necessary for waterproof installation.
 - G. Install matching flashing and closures as shown on drawings and in accordance with Section 076200. Install closures and angle flashings to close openings between deck and walls, columns, and openings.
 - H. Lap all flashings, and allow for thermal expansion.
- 3.5 FIELD QUALITY CONTROL
- A. At completion of each day's work and at work completion, sweep panels, flashings, and gutters clean. Do not allow fasteners, cuttings, fillings or scraps to accumulate on finish surfaces.

END OF SECTION 074113

SECTION 074646 FIBER CEMENT CLADDING

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. Related Requirements

1.2 SUMMARY

- A. Section Includes:
 - 1. Fiber-cement cladding.
 - 2. Fiber-cement soffits.
 - 3. Weather Barriers
 - 4. Vapor Permeable Air Barriers
- B. Coordinate siding installation with flashings and other adjoining construction to ensure proper sequencing.

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 1. For Vapor Permeable Air Barriers, Include:
 - a. Details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
 - b. Product test reports.
 - c. Field quality-control reports.
- B. Samples for Initial Selection: For fiber-cement cladding and soffit including related accessories.
 - 1. For Rain Screen installation, provide a sample mockup of all clips, battens or other components as would be installed in the field over substrate for the installation of the rain screen, at a minimum mockup size of 12"x12".
- C. Samples for verification: For each type, color, texture, and pattern required.
 - 1. 12-inch- long-by-actual-width Sample of Fiber Cement Cladding.
 - 2. 12-inch- long-by-actual-width Sample of Fiber Cement Soffits.
- D. Field Quality Control Reports: Provide for Vapor Permeable Air Barriers and all Fiber Cement Cladding installations.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of
 - 1. Fiber Cement Cladding , soffit
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for:
 - 1. Fiber-cement cladding , Soffit

- C. Research/Evaluation Reports: For each type of Fiber-Cement Cladding required.
- D. Field Quality-Control Reports for Rain Screen Assemblies and Vapor Permeable Air Barriers.
- E. Warranty: Sample of special warranty for all products.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of related accessories to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish full lengths of fiber-cement cladding and soffit including related accessories, in a quantity equal to 2 percent of amount installed.

1.8 QUALITY ASSURANCE

- A. Labeling: Provide fiber-cement siding or cladding that is tested and labeled according to ASTM C 1186 by a qualified testing agency acceptable to authorities having jurisdiction.
- B. Single Source Limitations:
 - 1. Obtain cladding, including related accessories, from single source from single manufacturer. Reveals or extrusions, if required, may be provided for concealed edge panel installations may be provided by a single, separate manufacturer in so much as cement fiber cladding warranty is maintained.
- C. Mockups:
 - 1. Cement Fiber Cladding
 - a. Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for fabrication and installation.
 - b. Build mockup of typical wall area as shown on Drawings.
 - c. 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.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with labels intact until time of use.
- B. Store materials on elevated platforms, under cover, and in a dry, well-ventilated, weathertight place.

1.10 COORDINATION

- A. Coordinate installation with flashings and other adjoining construction to ensure proper sequencing location.

1.11 WARRANTY

- A. Special Warranty: Standard form in which manufacturerManufacturer agrees to repair or replace that fail(s) in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:

- a. Structural failures including cracking, and deforming, and fading.
 - b. Deterioration of materials beyond normal weathering.
2. Warranty Period: 30 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FIBER-CEMENT CLADDING - SIDING (FC-S)

- A. General: ICC ESR-2290, ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84.
 1. Manufacturers: Subject to compliance with requirements, provide products by the basis of design, from one of the following, or equal:
 - a. Basis of Design Product: Allura Architectural Panels from Plycem; phone (844)425-5872; Address 15055 Woodham Drive, Houston, Texas 77073.
 - b. CertainTeed Corporation.
 - c. GAF Materials Corporation.
 - d. James Hardie Siding Products.
 - e. MaxiTile, Inc.
 - f. Nichiha Fiber Cement.
 - g. Norandex; Building Materials Distribution, Inc.
- B. Labeling: Provide fiber-cement siding that is tested and labeled according to ASTM C 1186 by a qualified testing agency acceptable to authorities having jurisdiction.
- C. Nominal Thickness: 5/16 inch (7.9 mm), plus or minus .04 inch (1 mm).
- D. Fiber Cement Wood Texture Horizontal Lap Siding (Type: FC-S-LS)
 1. Length: 12 feet (3657 mm), plus or minus 1/8 inch (3 mm).
 2. Style: Lap siding.
 3. Width: 12 inches (305 mm) wide.
 4. Factory Stain Finish: Factory applied. Red Rock Falls.
 5. Texture: Wood Grain
 6. Installation Type: Lap Siding, (no ventilated rain screen)
- E. Fiber Cement Smooth Vertical Panel Siding (Type: FC-S-PS)
 1. Style: Smooth panel.
 2. Factory Finishing: Factory applied, Red Rock Falls.
 3. Field Finish Paint: 100 percent acrylic latex as specified in Section 09 91 13.
 4. Trim: Provide concealed panel edges according to drawings and manufacturers requirements. Refer to accessories section of this specification.
 5. Installation Type: Ventilated Rain Screen Assembly, per manufacturer's requirements.
- F. Fiber Cement Smooth Vertical Panel Siding Board and Batten (Type: FC-S-BB)
 1. Style: Smooth panel.
 2. Factory Finishing: Factory applied. Linen.
 3. Field Finish Paint: 100 percent acrylic latex as specified in Section 09 91 13.
 4. Trim: Provide concealed panel edges according to drawings and manufacturers requirements. Refer to accessories section of this specification.
 5. Installation Type: Ventilated Rain Screen Assembly, per manufacturer's requirements.
 6. Batten: 4"x3/4" Smooth vertical Trim, at two feet on center

- G. 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. Products: Subject to compliance with requirements, provide the basis of design or one of the following:
 - a. DuPont (E. I. du Pont de Nemours and Company); Tyvek CommercialWrap
 - b. Ludlow Coated Products;
 - c. Pactiv, Inc.; GreenGuard
 - d. Raven Industries Inc.; Fortress Pro Weather Protective Barrier.
 - 2. Water-Vapor Permeance: Not less than 40 perms per ASTM E 96/E 96M, Desiccant Method (Procedure A).
 - 3. Air Permeance: Not more than 0.004 cfm/sq. ft. at 0.3-inch wg when tested according to ASTM E 2178.
 - 4. Allowable UV Exposure Time: Not less than three months.
- H. Panel and Siding Patterns as indicated in the drawings. Where no corner profile indicated, miter all siding edges.
 - 1. Factory Priming : Manufacturer's standard acrylic primer.

2.2 FIBER-CEMENT SOFFIT (FC-F)

- A. General: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:
 - a. Allura, Plycem
 - b. James Hardie.; HardieSoffit Panels
 - c. CertainTeed Corporation.
 - d. James Hardie Building Products, Inc.
 - e. James Hardie Siding Products.
 - f. MaxiTile, Inc.
 - g. Nichiha Fiber Cement.
 - h. Norandex; Building Materials Distribution, Inc.
- B. Nominal Thickness: Not less than 5/16 inch.
- C. 12 feet (3657 mm), plus or minus 1/8 inch (3 mm).
- D. Style: Wood grain
- E. Width: 12 inches (610 mm) wide.
- F. Thickness 1/4 inch
- G. Weight: 1.9 lbs/ sq. ft.
- H. Ventilation: Provide soffit.
- I. Factory Stain Finishing: Red Rock Falls .

- J. 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. Products: Subject to compliance with requirements, provide the basis of design or one of the following:
 - a. DuPont (E. I. du Pont de Nemours and Company); Tyvek CommercialWrap
 - b. Ludlow Coated Products;
 - c. Pactiv, Inc.; GreenGuard
 - d. Raven Industries Inc.; Fortress Pro Weather Protective Barrier.
 2. Water-Vapor Permeance: Not less than 40 perms per ASTM E 96/E 96M, Desiccant Method (Procedure A).
 3. Air Permeance: Not more than 0.004 cfm/sq. ft. at 0.3-inch wg when tested according to ASTM E 2178.
 4. Allowable UV Exposure Time: Not less than three months.

2.3 ACCESSORIES

A. Edge Accessories:

1. Manufacturer: Provide manufacturer as indicated or approved equal.
 - a. Stockton Products, Phone (877) 862-5866.
 - b. Fry Reglet Corporation
 - c. Brand X Metals, Inc
2. F Molding: Stockton FCB, 3/8 inch depth and 1/2 inch reveal, clear anodized aluminum, not painted.
3. J Molding: Stockton J MOLD-FCB 3/8 inch depth at smooth panels and 3/4 inch at lap siding, clear anodized aluminum, not painted.
4. Drip Scream: Stockton DS 7/8 inch depth and 3/4 inch reveal, clear anodized aluminum, not painted.
5. X Molding: Stockton OC-FCB 3/8 inch depth at smooth panels and 3/4 inch at lap siding, clear anodized aluminum, not painted.
6. Vertical Retainer: Fry FCP - VERT RET, clear anodized aluminum, not painted.
7. Starter Base: Stockton SB-FCB, clear anodized aluminum, not painted.
8. Head Drip: Fry FCP-HOZ Notch, clear anodized aluminum, not painted.
9. Inside Corner: IC-FCB, 5/16 inch at smooth panels and 3/4 in at lap siding clear anodized aluminum, not painted.
10. Soffit Vent Angled: Custom per drawings, clear anodized aluminum, not painted.
11. Soffit Vent Sheet: Custom per drawings, clear anodized aluminum, not painted.
12. Inside Corner: Stockton IC-FCP, clear anodized aluminum, not painted.

2.4 FASTENERS:

1. At siding use #8 x 1-1/4 inch long x .375 HD ribbed waferhead screw at 16 inches on center, blind screwed, per ICC ESR-2290.
2. At soffit panels use #8 x 1 5/8 inch long 410 stainless steel fiber cement board screws, square head at 12 inches on center.
3. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of 1/4 inch, or three screw-threads, into substrate.
4. For fastening fiber cement, use painted, **stainless-steel** fasteners to match panel finish where exposed.

2.5 MISCELLANEOUS MATERIALS

- A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.040 inch.
 - 1. Products: Subject to compliance with requirements, provide one of the following or equal:
 - a. DuPont (E. I. du Pont de Nemours and Company); DuPont Flashing Tape.
 - b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Vycor Butyl Self Adhered Flashing.
 - c. Protecto Wrap Company; BT-25 XL.
 - d. Raven Industries Inc.; Fortress Flashshield.
 - e. Advanced Building Products Inc.; Wind-o-wrap.
 - f. Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
 - g. Fiberweb, Clark Hammerbeam Corp.; Aquaflash 500.
 - h. Fortifiber Building Systems Group; Fortiflash 40.
 - i. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Vycor V40 Self-Adhered Flashing.
 - j. MFM Building Products Corp.; Window Wrap.
 - k. Polyguard Products, Inc.; Polyguard JT-30 Tape.
 - l. Sandell Manufacturing Co., Inc.; Presto-Seal.
- B. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.
- C. Nails and Staples: ASTM F 1667.

2.6

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of siding and soffit and related accessories.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION

- A. General Requirements: Cement Board Cladding
 - 1. Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
 - 2. Do not install damaged components.
 - 3. Attachment Spacing should comply with manufacturer's spacing requirements:
 - a. 1" minimum screw distance from vertical edge
 - b. 2" minimum screw distance from horizontal edge
 - c. 24" maximum spacer distance in vertical plane for wall attachments
 - d. 16" maximum spacer distance in horizontal plane for soffit attachments
 - e. 16" maximum screw distance in vertical plan

4. Panel Cutting per manufacturer's recommendations:
 - a. Cut panels using a high speed circular saw with a segmented diamond blade.
 - b. Cut panels from the front side and protect the face from being damaged during cutting.
 - c. For incidental cuts, cut panels from the front side using a jigsaw with a carbide tip blade.
 - d. Provide adequate ventilation during cutting. Use of a dust extractor is recommended.
 5. Drilling per manufacturer's recommendations:
 - a. Drilling of holes must be done from the front of the panel using a carbide tip drill bit.
 - b. Larger holes, or cut-outs on the panel, can be made by a jig saw with a carbide blade or a hole saw with a diamond blade.
 6. Contractor to coordinate location, spacing, and layout of studs, horizontal backing (or straps) with cement board attachment pattern/spacing and furring.
 7. Prepare structural backing with studs, sheathing, air barrier, and furring as required to meet the performance requirements specified. Install panels over a properly prepared support system in accordance with the manufacturer's installation instructions and approved shop drawings.
 8. As required, provide furring as required by manufacturer to create a ventilated rain screen assembly. All Furring elements to be attached with black EPDM rubber strips.
 9. Panels shall be attached to furring using the attachment pattern and fasteners indicated in the manufacturer's installation instructions and approved shop drawings.
 10. Predrill holes in cement boards in the pattern indicated in the manufacturers installation instructions and approved shop drawings. Holes shall be of size as specified by the panel manufacturer for the fasteners being used.
- B. General Requirements: Vapor Permeable Air Barrier
1. Cover exposed exterior surface of sheathing with water-resistive barrier securely fastened to framing immediately after sheathing is installed.
 2. Cover sheathing with water-resistive barrier as follows:
 - a. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
 - b. Apply barrier to cover vertical flashing with a minimum 4-inch overlap unless otherwise indicated.
 3. Building Paper: Apply horizontally with a 2-inch overlap and a 6-inch end lap; fasten to sheathing with galvanized staples or roofing nails.
 4. Building Wrap: Comply with manufacturer's written instructions.
 - a. Seal seams, edges, fasteners, and penetrations with tape.
 - b. Extend into jambs of openings and seal corners with tape.
- C. General Requirements: Flexible Flashing
1. Apply flexible flashing where indicated to comply with manufacturer's written instructions.
 - a. Prime substrates as recommended by flashing manufacturer.
 - b. 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.
 - c. Lap flashing over water-resistive barrier at bottom and sides of openings.
 - d. Lap water-resistive barrier over flashing at heads of openings.
 - e. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Inspect walls for any damage. Replace panels that are damaged. Do not attempt to repair.
- C. Ensure all dirt, dust, fingerprints and all foreign marks are immediately removed from the face of the material to avoid from permanent damage.
- D. All damaged products to be replaced prior to Substantial Completion.
- E. Install joint sealants as specified in Section 079200 "Joint Sealants" to produce a weathertight installation.

3.5 ADJUSTING AND CLEANING

- A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.
- B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 074646

SECTION 075552 - SBS MODIFIED BITUMINOUS MEMBRANE ROOFING, COLD-APPLIED

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. Section Includes: Styrene-butadiene-styrene (SBS) modified bituminous membrane roofing system, including:
 - a. Insulation and coverboard.
 - b. Base sheet.
 - c. Mineral granulated cap sheet.
 - d. Base flashing sheets.
- B. Related Requirements:
 - 1. Division 07 Section "Preparation for Re-Roofing".

1.3 DEFINITIONS

- A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work. Provide roof plan showing orientation and types of roof deck, orientation of membrane roofing, and fastening spacings and patterns for mechanically fastened components.
 - 1. Base flashings and built-up terminations.
 - a. Indicate details meet requirements of NRCA required by this Section.
 - 2. Crickets, saddles, and tapered edge strips, including slopes.
 - 3. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
- C. Samples for Verification: For the following products:
 - 1. Sheet roofing materials, of color specified for exposed material.
 - 2. Roof insulation, cover board, and substrate board.

1.5 INFORMATIONAL SUBMITTALS

- A. Contractor's Product Certificate: Submit certificate, indicating products intended for Work of this Section, including product names and numbers and manufacturers names, with statement indicating that products to be provided meet the requirements of the Contract Documents.
- B. Qualification Data: For Installer, Manufacturer, and Roofing Inspector.
 - 1. Include letter from Manufacturer written for this Project indicating approval of Installer.
- C. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - 1. Submit evidence of compliance with performance requirements, including UL listing certificate and Energy Performance.

2. Indicate that proposed system components are compatible.
 - D. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of modified bitumen roofing.
 - E. Warranties: Unexecuted sample copies of warranties.
 - F. Field Quality Control Reports: Daily reports of Roofing Inspector. Include weather conditions, description of work performed, tests performed, defective work observed, and corrective actions taken to correct defective work.
- 1.6 CLOSEOUT SUBMITTALS
- A. Maintenance Data: To include in maintenance manuals.
 - B. Warranties: Executed copies of warranties.
- 1.7 QUALITY ASSURANCE
- A. Installer Qualifications: An employer of workers trained and certified by manufacturer, including a full-time on-site supervisor with a minimum of five years' experience installing products comparable to those specified, able to communicate verbally with Contractor and employees, and qualified by the manufacturer to install manufacturer's product and furnish warranty of type specified.
 - B. Manufacturer Qualifications: Approved manufacturer with UL listed roofing systems comparable to those specified for this Project, with minimum five years' experience in manufacture of comparable products in successful use in similar applications, and able to furnish warranty with provisions matching specified requirements.
 1. Approval of Other Manufacturers and Comparable Products: Submit the following in accordance with project substitution requirements, within time allowed for substitution review:
 - a. Product data, including certified independent test data indicating compliance with requirements.
 - b. Samples of each component.
 - c. Sample submittal from similar project.
 - d. Project references: Minimum of five installations of specified products not less than five years old, with Owner contact information.
 - e. UL listing including deck types and slopes.
 - f. Sample warranty.
 2. Substitutions following award of contract are not allowed.
 3. Approved manufacturers must meet separate requirements of Submittals Article.
 - C. Roofing Inspector Qualifications: A technical representative of manufacturer not engaged in the sale of products and experienced in the installation and maintenance of the specified roofing system, qualified to perform roofing observation and inspection specified in Field Quality Control Article, to determine Installer's compliance with the requirements of this Project, and approved by the manufacturer to issue warranty certification. The Roofing Inspector shall be one of the following:
 1. An authorized full-time technical employee of the manufacturer.
 - D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products.
 - E. Preinstallation Roofing Conference: Conduct conference at Project site.

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

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 PROJECT 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.
- B. Daily Protection: Coordinate installation of roofing so insulation and other components of roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
 1. Provide tie-offs at end of each day's work to cover exposed roofing and insulation with a course of roofing sheet securely in place with joints and edges sealed.
 2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing.
 3. Remove temporary plugs from roof drains at end of each day.
 4. Remove and discard temporary seals before beginning work on adjoining roofing.

1.10 WARRANTY

- A. **Manufacturer's Warranty:** Manufacturer's standard or customized form in which manufacturer agrees to repair or replace components of modified bitumen roofing that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.
 - 1. Manufacturer's warranty includes roofing membrane, base flashings, fasteners, roofing membrane accessories, insulations, and other components of roofing system specified in this Section.
 - 2. Warranty Period: 20 years from date of Substantial Completion.
- B. **Installer's Warranty:** Submit roofing Installer's warranty, signed by Installer, covering the Work of this Section and related Sections indicated above, including all components of modified bitumen roofing such as modified bitumen roofing membrane, base flashing, roof insulation, fasteners, cover boards, substrate 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. **Basis-of-Design Manufacturer/Product:** The roof system specified in this Section is based upon products of Tremco, Inc. Provide specified products or approved equivalent products.
- B. **Source Limitations:** Obtain components for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.
- C. Any proposed material substitutions must be submitted to the District 7 days prior to the bid due date.

2.2 PERFORMANCE REQUIREMENTS

- A. **General Performance:** Roofing shall withstand exposure to weather without failure or leaks due to defective manufacture or installation.
 - 1. Accelerated Weathering: Roofing system shall withstand 2000 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:** Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.
- C. **SPRI Wind Design Standard:** Manufacture and install copings and roof-edge flashings according to SPRI ES-1.
- D. **Flashings and Fastening:** Provide base flashings, perimeter flashings, detail flashings and component materials and installation techniques that comply with requirements and recommendations of the following:
 - 1. NRCA Roofing Manual (Sixth Edition) for construction details and recommendations.
 - 2. SMACNA Architectural Sheet Metal Manual (Seventh Edition) for construction details.
- E. **Exterior Fire-Test Exposure:** ASTM E 108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.

- F. Energy Performance: Roofing system shall have an initial solar reflectance index of not less than 0.70 and an emissivity of not less than 0.75 when tested according to CRRC-1.

2.3 ROOFING MEMBRANE MATERIALS

A. Base Sheet:

1. ASTM D6164, Grade S, Type I, glass-fiber-reinforced, SBS/SEBS-modified asphalt sheet; smooth surfaced.
 - a. POWERply HE Smooth
 - b. Tensile Strength at 0 deg. F, minimum, ASTM D 5147: Machine direction, 165 lbf/in; cross machine direction, 140 lbf/in.
 - c. Tear Strength minimum, ASTM D 5147: machine direction, 160 lbf; cross machine direction 290 lbf.
 - d. Elongation at 73 deg. F, minimum, ASTM D 5147: machine direction, 7.0 percent; cross machine direction, 7.0 percent.
 - e. Thickness, minimum, ASTM D 5147: 0.094 inch.

B. Membrane Sheets:

1. ASTM D 4601 Type II nonperforated asphalt-impregnated and coated glass-fiber sheet, dusted with fine mineral surfacing on both sides.
 - a. Breaking Strength, minimum, ASTM D 146: Machine direction, 90 lbf/in (15.7 kN/m); Cross machine direction, 70 lbf/in (12.2 kN/m).
 - b. Pliability, 1/2-inch (12.7 mm) radius bend, ASTM D 146: No failures.
 - c. Weight, ASTM D 228: 33 lb/100 sq. ft. (1.6 kg/m²).

C. SBS Modified Bituminous Cap Sheet:

1. ASTM D 6163, Grade G, Type I, glass-fiber-reinforced, SBS-modified asphalt sheet; factory coated granular surfaced; suitable for application method specified, and as follows:
 - a. POWERply Standard FR T24
 - b. Exterior Fire-Test Exposure, ASTM E 108: Class A.
 - c. Tensile Strength at 0 deg. F (-18 deg. C), minimum, ASTM D 5147: Machine direction 130 lbf/in (14.0 kN/m); Cross machine direction 100 lbf/in (12.0 kN/m).
 - d. Tear Strength at 77 deg. F (25 deg. C), minimum, ASTM D 5147: Machine direction, 100 lbf (440 N); Cross machine direction 90 lbf (440 N).
 - e. Low Temperature Flex, maximum, ASTM D 5147: -10 deg. F.
 - f. Thickness, minimum, ASTM D 5147: 0.157 inch (4 mm).
 - g. SRI Initial: 93
 - h. SRI 3 Year: 74

D. Base Flashing Backer Sheet:

1. ASTM D 4601 Type II nonperforated asphalt-impregnated and coated glass-fiber sheet, dusted with fine mineral surfacing on both sides.
 - a. Burmastic Glass Ply 33lb.
 - b. Breaking Strength, minimum, ASTM D 146: Machine direction, 90 lbf/in (15.7 kN/m); Cross machine direction, 70 lbf/in (12.2 kN/m)..
 - c. Pliability, 1/2-inch (12.7 mm) radius bend, ASTM D 146: No failures.
 - d. Weight, ASTM D 228: 33 lb/100 sq. ft. (1.6 kg/m²).

E. Base Flashing Sheet:

1. Thermoplastic PVC/TPA sheet, ASTM D 4434 Type IV internally fabric reinforced, Energy Star qualified, CRRC listed, and California Title 24 Energy Code compliant.

- a. Tremco TPA Single Ply Membrane
 - b. Tensile Strength at 0 deg. F (-18 deg. C), minimum, ASTM D 751: 300 lbf/in (52 kN/m).
 - c. Tear Strength at 77 deg. F (25 deg. C), minimum, ASTM D 751: 100 lbf (440 N).
 - d. Elongation at 0 deg. F (-18 deg. C), minimum at fabric break, ASTM D 751: 25 percent.
 - e. Minimum Thickness, nominal, ASTM D 751: 45 mils (1.1 mm).
 - f. Recycled Content, minimum: 25 percent preconsumer.
 - F. Stripping Sheets:
 - 1. ASTM D 4601 Type II nonperforated asphalt-impregnated and coated glass-fiber sheet, dusted with fine mineral surfacing on both sides.
 - a. Burmastic Glass Ply 33lb.
 - b. Breaking Strength, minimum, ASTM D 146: Machine direction, 90 lbf/in (15.7 kN/m); Cross machine direction, 70 lbf/in (12.2 kN/m).
 - c. Pliability, 1/2-inch (12.7 mm) radius bend, ASTM D 146: No failures.
 - d. Weight, ASTM D 228: 33 lb/100 sq. ft. (1.6 kg/m²).
 - G. Fluid-Applied Flashing Materials:
 - 1. Polyurethane roof coating system base coat, bio-based, low-odor low-VOC two-part, for use with a compatible top coat.
 - a. Alpha Guard Bio Base Coat
 - b. Solids, by volume, ASTM D 2697: 100 percent.
 - c. Bio-Based Content: Not less than 70 percent.
 - 2. Polyurethane roof coating system top coat, bio-based low-odor low-VOC two-part, for application over compatible base coat.
 - a. Alpha Guard Bio Top Coat
 - b. Solar Reflectance Index (SRI), ASTM E 1980: 103.
 - c. Solids, by volume, ASTM D 2697: 85 percent.
 - d. Bio-Based Content: Not less than 60 percent.
 - 3. Polyester Reinforcing Fabric: 100 percent stitch-bonded mildew-resistant polyester fabric intended for reinforcement of compatible fluid-applied membranes and flashings.
 - a. Tensile Strength, ASTM D 1682: Not less than 50 lbf. (222 N).
 - b. Elongation, ASTM D 1682: Not less than 60 percent.
 - c. Tear Strength, ASTM D 1117: Not less than 16 lbf. (70 N).
 - d. Weight: 3 oz./sq. yd (102 g/sq. m).
 - H. Glass-Fiber Fabric:
 - 1. Woven Glass Fiber Mesh, Vinyl-Coated: Non-shrinking, non-rotting, vinyl-coated woven glass mesh for reinforcing flashing seams, membrane laps, and other roof system detailing.
 - a. Tensile strength, 70 deg. F, ASTM D 146: Warp, 65 lbf/in (289 N); fill, 75 lbf/in (311 N).
- 2.4 COLD-APPLIED ADHESIVE MATERIALS
- A. General: Adhesive and sealant materials recommended by roofing system manufacturer for intended use and compatible with roofing membrane.
 - 1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

- B. Membrane Seam Adhesive: Two-part urethane, 100% solids, bio-based, asbestos free, cold applied roof membrane adhesive.
 - a. Volatile Organic Compounds (VOC), maximum, ASTM D 3960: 1 g/L.
 - b. Density, minimum, ASTM D 1475: 11.1 lbs/gal.
 - c. Volume Solids, minimum, ASTM D 2697: 100%.
 - d. Weight Solids, minimum, ASTM D 1644: 100%.
- C. Ply, Stripping Ply, Backer Sheet, and Cap Sheet Adhesive:
 - 1. Two-part urethane, 100% solids, bio-based, asbestos free, cold applied roof membrane adhesive.
 - a. Volatile Organic Compounds (VOC), maximum, ASTM D 3960: 1 g/L.
 - b. Density, minimum, ASTM D 1475: 11.1 lbs/gal.
 - c. Volume Solids, minimum, ASTM D 2697: 100%.
 - d. Weight Solids, minimum, ASTM D 1644: 100%.
- D. Flashing Sheet Adhesive:
 - 1. Elastomeric low-VOC solvent-based contact-type adhesive for bonding TPA non-fleece-backed single ply membranes and flashings to substrates.
 - a. TPA LV Bonding Adhesive.
 - b. VOC, maximum, ASTM D 3960: <200 g/L.
- E. Asphalt Roofing Mastic: ASTM D 4586, asbestos free, of consistency required by roofing system manufacturer for application.
- F. Mastic Sealant: Polyisobutylene, plain or modified bitumen, nonhardening, nonmigrating, nonskinning, and nondrying.

2.5 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing membrane.
- B. Fasteners Factory-coated steel fasteners and metal plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roofing components to substrate, tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer.
- C. Base Sheet Mechanical Fasteners: Manufacturer's standard 2-inch wide barbed galvanized steel seam plate.
- D. Stripping Reinforcing Fabric:
 - 1. ASTM D 4601 Type II nonperforated asphalt-impregnated and coated glass-fiber sheet, dusted with fine mineral surfacing on both sides.
 - a. Breaking Strength, minimum, ASTM D 146: Machine direction, 90 lbf/in (15.7 kN/m); Cross machine direction, 70 lbf/in (12.2 kN/m).
 - b. Pliability, 1/2-inch (12.7 mm) radius bend, ASTM D 146: No failures.
 - c. Weight, ASTM D 228: 33 lb/100 sq. ft. (1.6 kg/m²).
- E. Joint Sealant: Elastomeric joint sealant compatible with roofing materials, with movement capability appropriate for application.
 - 1. Joint Sealant, Polyurethane: ASTM C 920, Type S, Grade NS, Class 50 single-component moisture curing sealant, formulated for compatibility and use in dynamic and static joints; paintable.
 - a. Volatile Organic Compounds (VOC), maximum, ASTM D 3960: 40 g/L.
 - b. Hardness, Shore A, ASTM C 661: 40.

- c. Adhesion to Concrete, ASTM C 794: 35 pli.
 - d. Tensile Strength, ASTM D 412: 350 psi.
 - e. Color: Closest match to substrate.
 - F. Metal Coating: ASTM D 6083, solar-reflective acrylic elastomer emulsion coating.
 - G. Metal Flashings:
 - 1. Aluminum termination bar: 1/8 x 1 inch
 - 2. T-Tops: 22 gauge galvanized steel with sides and screens.
 - 3. Passive vents:
 - a. Units shall be of bolted and welded construction utilizing corrosion resistant fasteners.
 - b. Hood shall be constructed of 18 gauge galvanized steel, bolted to 12 gauge galvanized steel support structure.
 - c. Base shall have continuously welded curb cap corners.
 - d. Bird screen constructed of 1/2" galvanized mesh shall be mounted in the hood.
 - e. Slope top to shed water.
 - 4. Whirly birds: match existing.
 - 5. Counterflashing and counterflashing extensions:
 - a. General: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces and compatible with flashing indicated.
 - b. Galvanized Steel Sheet: ASTM A526, G90, commercial quality, or ASTM A527, G90, lock-forming quality, hot-dip galvanized steel sheet with 0.20 percent copper.
 - c. Galvanized Steel Sheet: 24 gage (0.0276 inch) (0.7010 mm).
 - d. Masonry Type: Provide with offset top flange for embedment in masonry mortar joints.
 - 6. Counterflashing Wind-Restraint Clips:
 - a. Provide hold down clips with 1/2 inch (12.7 mm) kickout to be installed before counterflashing to prevent wind uplift on the counterflashing lower edge. Fabricate the clips of the following materials:
 - 7. Galvanized Steel: 22 gage; 0.0336 inch (0.8534 mm) thick.
 - H. Lead Flashings:
 - 1. ASTM B 29-79 (84), four lb. sheet lead.
 - I. Drains:
 - 1. Zurn or equal.
 - J. Work shall be in accordance with Architectural Sheet Metal Manual, as issued by Sheet Metal and Air Conditioning Contractors' National Association, Inc., (SMACNA).
 - K. Miscellaneous Accessories: Provide miscellaneous accessories recommended by roofing system manufacturer.
- 2.6 COVER BOARDS
- A. Cover Board:
 - 1. Metal Decks: Cellulosic fiber reinforced water-resistant gypsum panel, ASTM C 1278/C 1278M.
 - a. Thickness: 1/4 inch.

2.7 ROOF INSULATION

- A. Roof Insulation, General: Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.
 - 1. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to a minimum slope of ¼ inch per 12 inches.
- B. Polyisocyanurate board insulation, ASTM C 1289 Type II Class 1 CFC- and HCFC- free, with recycled content glass-fiber mat facer on both major surfaces.
 - 1. Compressive Strength, ASTM C1621: Grade 2: 20 psi (138 kPa).
 - 2. Conditioned Thermal Resistance at 75 deg. F (24 deg. C): 14.4 at 2.5 inches (50.8 mm) thick.
 - 3. Thickness: R-30
- C. Insulation Cant Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.
- D. Tapered Edge Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.
- E. Substrate Joint Tape: 6- or 8-inch- wide, coated, glass-fiber joint tape.

2.8 COATING MATERIALS

- A. Acrylic Coating Material:
 - 1. Acrylic Roof Coating, Highly-Reflective Elastomeric: ASTM D 6083, applied as base coat plus finish coat over prepared and primed roof surfaces.
 - a. Solar Reflectance Index (SRI), white, ASTM E 1980: 105 initial; 100 aged.
 - b. Volatile Organic Compounds (VOC), maximum, ASTM D 3960: Less than 50 g/L.
 - c. Tensile Strength at 73 deg. F (23 deg. C), minimum, ASTM D 2370: Not less than 250 psi (1700 kPa).
 - d. Elongation at 73 deg. F (23 deg. C), minimum, ASTM D 2370: Not less than 350 percent.
 - e. Flexibility at -15 deg F (-26 deg C), ASTM D 522: Pass 1/2 inch mandrel after 1000 hrs. accelerated weathering.
 - f. Solids by weight, ASTM D 1644: Not less than 60 percent.
 - g. Solids by volume, ASTM D 2697: Not less than 50 percent.
 - h. Color, Top Coat: White.
- B. Acrylic Coating Primer:
 - 1. Acrylic-based primer formulated for use with acrylic latex coatings.

2.9 WALKWAYS AND BLOCKS

- A. Walkway Material:
 - 1. Walkway pads, ceramic-granule-surfaced reinforced asphaltic composition slip-resisting pads, manufactured as a traffic pad for foot traffic, 1/2 inch (13 mm) thick minimum.
 - a. Flexural Strength at max. load, minimum, ASTM C 203: 210 psi (1.5 kPa).
 - b. Granule adhesion (weight loss), maximum, ASTM D 4977: 1.1 gram.
 - c. Impact Resistance at 77 deg. F (25 deg. C), ASTM D 3746: No Damage to Roof.
 - d. Pad Size: 36 by 48 inch (914 by 1220 mm).
- B. Rubber Blocks: 100% rubber blocks with steel channels and reflective strips designed for supporting conduit.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
 - 1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
 - 2. Verify that blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - 3. Wood Roof Deck: Verify that wood deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch out of plane relative to adjoining deck.
- 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.

3.3 INSTALLATION, GENERAL

- A. Install roofing system in accordance with manufacturer's recommendations.
- B. Install new treated wood nailers at all coping locations and at edge metal locations where insulation is installed. Nailers must match height of insulation.
- C. Install roofing system in accordance with the following NRCA Manual Plates and NRCA recommendations; modify as required to comply with manufacturer's requirements:
 - 1. Base Flashing at Parapet Wall With Metal Coping: MB-1.
 - 2. Base Flashing With Two-piece Sheet-metal Counterflashing: MB-5.
 - 3. Base Flashing at Roof-to-wall Expansion Joint: MB-7.
 - 4. Equipment Support Curb and Sleeper: MB-9.
 - 5. Equipment Support Stand: MB(L)-10.
 - 6. Raised Curb Detail at Rooftop HVAC Units, Premanufactured: MB-12.
 - 7. Raised Curb Detail (Job site constructed wood curb): MB-13.
 - 8. Penetration, Structural Member through Roof Deck: MB(L)-14.
 - 9. Penetration, Sheet Metal Enclosure for Piping Through Roof Deck: MB-15.
 - 10. Penetration, Isolated Stack Flashing: MB-18.
 - 11. Penetration, Plumbing Vent: MB(L)-19.
 - 12. Roof Drain: MB-25.
 - 13. Overflow Scupper: MB-27.
 - 14. Guide for Clearances between Pipes / Walls / Curbs - Table 4
 - 15. Guide for Crickets and Saddles - Table 5
 - 16. Skylight, Scuttle (Roof Hatch), and Smoke Vents: Plates MB-14 and MB-14S and Division 07 Section "Roof Accessories."
 - 17. Expansion Joint with Metal Cover: Plates MB-7 and MB-7S and Division 07 Section "Sheet Metal Flashing and Trim."

18. Expansion Joint with Premanufactured Cover: Plates MB-7A and MB-7AS and Division 07 Section "Roof Expansion Assemblies."

3.4 INSULATION INSTALLATION

- A. Comply with roofing manufacturer's written instructions for installing roof insulation.
- B. Cant Strips: Install and secure preformed 45-degree cant strips at junctures of built-up roofing with vertical surfaces or angle changes greater than 45 degrees. Mechanically attach cant strip.
- C. Install tapered insulation crickets under area of roofing to conform to ¼:12 minimum slope. Install crickets on the high side of all curbs.
- D. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between bboards. Fill gaps exceeding ¼ inch (6mm) with insulation.
 - 1. Cut and fit insulation within ¼ inch of nailers, projections, and penetrations.
- E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict the flow of water.
- F. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.
- G. Mechanically fastened insulation: Install insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck. Fasten per roof system manufacture's recommendations. Adhere insulation over deck areas where fasteners would be visible on the underside of the decking.
- H. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
 - 1. Fasten substrate board to wood decks per manufacturer's recommendations. Adhere substrate board over deck areas where fasteners would be visible on the underside of the decking.

3.5 COLD-APPLIED ROOFING MEMBRANE INSTALLATION, GENERAL

- A. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.
- B. Cooperate with testing agencies engaged or required to perform services for installing roofing system.
- C. Coordinate installation of roofing system so insulation and other components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
 - 1. Provide tie-offs at end of each day's work configured as recommended by NRCA Roofing Manual Appendix: Quality Control Guidelines - Insulation to protect new roofing.
 - 2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing.
 - 3. Remove temporary plugs from roof drains at end of each day.
 - 4. Remove and discard temporary seals before beginning work on adjoining roofing.
- D. Substrate-Joint Penetrations: Prevent roofing asphalt and adhesives from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

3.6 SBS-MODIFIED BITUMINOUS MEMBRANE INSTALLATION

- A. Install modified bituminous roofing membrane sheets according to roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants, installing as follows:
 - 1. Unroll roofing membrane sheets and allow them to relax for minimum time period required by manufacturer.
 - 2. Laps: Accurately align roofing membrane sheets, without stretching, and maintain uniform side and end laps. Plan layout to stagger lap seams and end laps. Install roofing membrane sheets so side and end laps shed water. Completely bond and seal laps, leaving no voids.
 - 3. Commence layout at low point of roof area.
 - 4. Repair tears and voids in laps and lapped seams not completely sealed.
- B. Mechanically-Fastened Base Sheet:
 - 1. Install lapped base-sheet course, extending sheet over and terminating beyond cants.
 - 2. Starting at one end of sheet, install mechanical fasteners along center of 4 inch side lap. Install fasteners to set the seam plate tight to the membrane. Do not overdrive fastener. Do not ripple or wrinkle the membrane. Fasten to metal decks as required by manufacturer.
 - 3. Adjust fastener spacing at perimeter and corners. Cover exposed fasteners in field of base sheet with 6 inch strips of base sheet adhered in base sheet overlap adhesive.
 - 4. Lap Seam Treatment: Adhere side and end lap seams with base sheet overlap adhesive and roll using weighted roller in accordance with manufacturer's instructions.
 - 5.
- C. Smooth Ply Sheet:
 - 1. Fully embed ply sheet in cold-applied membrane adhesive where required by manufacturer applied at rate required by roofing manufacturer at all curbs, walls, over crickets, and through waterways. Roll sheet using weighted roller. Ensure complete and continuous seal and contact between adhesive and membrane without wrinkles, fish-mouths, and blisters.
- D. Granular Surfaced Cap Sheet:
 - 1. Fully embed sheet in cold-applied membrane adhesive applied at rate required by roofing manufacturer. Roll sheet using weighted roller. Ensure complete and continuous seal and contact between adhesive and membrane without wrinkles, fish-mouths, and blisters.
 - 2. Apply white granules matching cap sheet granules to all bleed out.
 - 3. Apply sealant at gap between cap sheet and edge metal.
 - 4. Apply coating to any areas where factory coating is disturbed, damaged or stained. Completed surfacing must be uniformly white, matching factory coated cap sheet.

3.7 FLASHING AND STRIPPING INSTALLATION

- A. Install base flashing over cant strips and other sloped and vertical surfaces, at roof edges, and at penetrations through roof; secure to substrates according to roofing system manufacturer's written instructions, and as follows:
 - 1. Extend base flashing up walls or parapets and 6 inches onto field of modified bitumen roofing.
 - 2. Prime substrates with asphalt primer if required by roofing system manufacturer.
 - 3. Backer Sheet Application: Mechanically attach to substrate.

4. Flashing Sheet Application: Adhere flashing sheet to substrate in cold-applied adhesive. Apply cold-applied flashing sheet adhesive to back of flashing sheet and substrate as required by manufacturer.
5. Fluid-Applied Flashing Application: Apply base coat with embedded fabric reinforcement and top coat at penetrations and drains in accordance with manufacturer's written instructions.
 - a. Apply base coat at minimum wet mil coating thickness of 48 mils unless additional thickness is recommended by manufacturer.
 - b. Apply top coat over field base coat and spread coating evenly. Apply top coat at minimum wet mil thickness of 32 mils unless additional thickness is recommended by manufacturer.
- B. Seal top termination of base flashing at walls with a metal termination bar, butyl tape, and sealant. Seal top of base flashing at curbs with a skirt metal counterflashing. Extend base flashing sheet over walls where coping is present or to be installed.
- C. Install roofing stripping plies where metal flanges and edgings are set on membrane roofing according to roofing system manufacturer's written instructions. Secure metal flanges at 3" oc staggered with three pan head screws and sealant at all overlaps.
- D. Construct new wood curbs for units sitting on roof or sleepers. Wrap curb with flashing membrane and install new 24-gauge sheet metal pans.
- E. Construct new wood curbs and sheet metal pelican hoods for insulated lines and multiple lines entering the deck at the same location.
- F. Install new heater stack flashings, counterflashings, and tops.
- G. Seal all duct and pan seams and seams on other metal components with acrylic sealer and polyester reinforcement. Coat all uncoated metal including ducts, pans, box drains, and drain rings and screens with metal coating at a rate of 3 gallons per square. Prime metal prior to coating application.
 1. Properly disconnect and lift units to access pan location and seams under units.
- H. Cover expansion joints with elastomeric membrane set in bonding adhesive. Strip in with liquid applied flashing system. Surface with granules. Install new sheet metal expansion joint covers.
- I. Roof Drains: Set metal flashing in bed of asphalt roofing mastic on completed ply assembly. Cover metal flashing with roofing stripping plies and extend a minimum of 12 and 24 inches beyond edge of metal flashing onto field of roofing membrane. Install modified cap sheet and clamp roofing membrane, metal flashing, and stripping into roof-drain clamping ring.
 1. Install stripping according to roofing system manufacturer's written instructions.
- J. Elastomeric Flashing:
 1. Adhere TPA completely to flashing surface, cant, and roofing with flashing adhesive. Prime surface as required. Apply adhesive in full coverage to both the substrate and to the back side of the flashing membrane. Allow adhesive to dry to the touch.
 - 2.
 3. Apply consistent pressure to entire surface of TPA using a steel hand roller to achieve full adhesion of the sheet to the flashing substrate. Ensure complete bond and continuity without wrinkles or voids. Lap sheeting ends 4 inches. Fully heat weld flashing laps.
 4. TPA width: Sufficient to extend at least 6 inches beyond toe of cant onto new roof.
 - 5.

6. Seal horizontal edge of TPA with a five-course application of Rock-It Adhesive and fiberglass reinforcement.
 - 7.
 8. Seal vertical edge under counterflashings with Termination bar and TF tape secured at 8" o.c. and a skirt metal with TF tape secured at 8" o.c. at curbs.
 - 9.
 10. Secure TPA under existing flanges of expansion joint covers and non-removable metal components using skirt metal and TF tape. All skirt metal shall be of sufficient size to extend a minimum of 4 inches down from attachment to TPA. Skirt metal to be fastened with screws with neoprene washers a minimum of 8 inches o.c. and each screw must fully engage all metal components, the flashing sheet and the substrate.
- K. Hot air heat welding of TPA:
1. Wipe both sides of lap surfaces to be joined with solvent approved by manufacturer.
 - 2.
 3. Adjust welding equipment air temperature prior to start. Utilize steel roller or weighted wheel on automatic welding equipment to provide pressure on lap area during heat welding.
 - 4.
 5. Maintain air nozzle temperature, nozzle speed, and lap pressure when joining laps together.
 - 6.
 7. Test lap areas to assure proper bonding. Remove lap sample from the roof. When lap sample is cool, pull test lap apart. When torn, the reinforcing scrim should become exposed. Patch test areas with new TPA of the same color and style, using a minimum 2" lap area.
 - 8.
 9. Wipe top of lap seams with approved solvent and apply silicone sealant. Tool sealant to a coved bead.
- L. Base flashing height:
1. Not less than 8 inches without manufacturer's written approval. If height of base flashing exceeds 24 inches, a batten bar with TF tape must be installed at the midpoint of the sheet. Heat weld a strip of TPA over the batten bar.
- M. Two-Ply Stripping for metal flanges:
1. Set flange in modified mastic. Seal flange with two stripping plies embedded in specified adhesive. Extend first ply a minimum 8 inches beyond flange and the second 14 inches. Carefully rub in the ply to insure complete adhesion.
- N. At walls with counter flashing:
1. Remove and re-use existing counter flashing.
 - 2.
 3. All counter flashing not at 8 inches off the finished roof surface must be raised to 8 inches.
 - 4.
 5. Extend base flashing to underside of counter flashing reglet.
 - 6.
 7. Install termination bar to top of base flashing with one layer of T.F. tape behind termination bar.
 - 8.

9. Fasten termination bar with appropriate fasteners at a minimum of 8 inches on center.
- O. At walls with coping:
1. Install base flashing as described in general flashing requirements.
 - 2.
 3. Extend backer sheet and base flashing under interior coping metal face to top of parapet wall.
 - 4.
 5. Install 6 inch minimum skirt metal between coping metal and base flashing. Secure with fasteners with neoprene washers that engage coping metal, skirt metal, base flashing and substrate. Install fasteners every 8 inches.
- P. Curb flashings:
1. Add to existing wood curbs or construct new curbs to achieve minimum 8" height with proper wood nailers. As needed, install new plywood and supports to create substrate necessary for proper flashing.
 - 2.
 3. Fully adhere TPA over the top of curbs that receive sheet metal pans.
 - 4.
 5. Secure substrate board to metal curbs to match wood nailer.
 - 6.
 7. Install elastomeric flashing sheet as described in general flashing requirements section.
 - 8.
 9. Secure top edge of flashing membrane to vertical substrate with skirt metal and one layer of TF tape secured 8 inches o.c. maximum.
 - 10.
 11. Wipe top of bar clean with metal cleaner. Prime metal surface to receive sealant with metal primer. Allow to dry.
 - 12.
 13. Caulk top of bar with polyurethane sealant. Provide watershed. Tool neatly.
 - 14.
 15. Seal all holes, screws, and penetrations on equipment with polyurethane sealant.

3.8 WALKWAY AND BLOCK INSTALLATION

- A. Walkway Pads: Install walkway pads using units of size indicated according to walkway pad manufacturer's written instructions. Install per layout on plans. At a minimum walk pads must be installed around serviceable equipment and in a path to the roof access hatch/point.
1. Sweep away loose aggregate surfacing.
 2. Set walkway pads in spot application of mastic.
- B. Pipe/conduits sitting on roofs shall be set on and clamped to new rubber blocks with steel channels.
1. Support lines every 8 feet on pipe runs along with support on each side of every union, junction, and direction change.

3.9 FIELD QUALITY CONTROL

- A. Roofing Inspector: Contractor shall engage a qualified roofing inspector for daily inspections during the entire roof project to perform roof tests and inspections and to prepare start up, interim, and final reports. Roofing Inspector's quality assurance inspections shall comply with criteria established in ARMA/NRCA's "Quality Control Guidelines for the Application of Built-up Roofing."

- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation at commencement and upon completion.
- C. Repair or remove and replace components of built-up roofing where test results or inspections indicate that they do not comply with specified requirements.
 - 1. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.10 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copy to 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.

END OF SECTION 075552

SECTION 076200 - SHEET METAL FLASHING AND TRIM

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. Prefinished aluminum sheet metal
 - 2. Manufactured reglets with counterflashing.
 - 3. Formed roof-drainage sheet metal fabrications.
 - 4. Formed low-slope roof sheet metal fabrications.
 - 5. Formed wall sheet metal fabrications.
 - 6. Formed equipment support flashing.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
- B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:
 - 1. Identification of material, thickness, weight, and finish for each item and location in Project.
 - 2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
 - 3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 - 4. Details of termination points and assemblies, including fixed points.
 - 5. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction.
 - 6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
 - 7. Details of special conditions.
 - 8. Details of connections to adjoining work.

- C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
 - 1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified fabricator.
- B. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
- B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

PART 2 - PRODUCTS

2.1 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.
- B. Aluminum Sheet: 0.063 inch, ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.
 - 1. Surface: Smooth, flat.
 - 2. Two-Coat Fluoropolymer: AAMA 605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Color as selected by Architect from manufacturer's full range.

2.2 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

- B. Fasteners: Self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
 - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
 - 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

2.3 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.
 - 1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 - 2. Obtain field measurements for accurate fit before shop fabrication.
 - 3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
 - 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- C. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."
- D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.
- E. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
- F. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- G. Do not use graphite pencils to mark metal surfaces.

2.4 ROOF-DRAINAGE SHEET METAL FABRICATIONS

- A. Hanging Gutters: Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch-long sections.

- 2.5 Furnish flat-stock gutter brackets and flat-stock gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard but with thickness not less than twice the gutter thickness dimension indicated on Drawings. Fabricate expansion joints,

expansion-joint covers, and gutter accessories from same metal as gutters. Shop fabricate interior and exterior corners.

1. Gutter Profile: As indicated on Drawings.
2. Expansion Joints: Butt type with cover plate.
3. Accessories: Continuous, removable leaf screen with sheet metal frame and

2.6 hardware cloth screen and wire-ball downspout strainer.

2.7 4. Gutters with Girth up to 25 Inches: Fabricate from the following materials:

2.8 a. Galvanized Steel: 0.034 inch thick.

2.9 5. Gutters with Girth 26 to 30 Inches: Fabricate from the following materials

2.10 a. Galvanized Steel: 0.040 inch thick

A. 6. Gutters with Girth 31 to 35 Inches: Fabricate from the following materials:

B. a. Galvanized Steel: 0.052 inch thick. B. Steel Pipe Downspouts:

Fabricate round downspouts to dimensions indicated, complete with mitered elbows. Furnish with metal hangers. Shop fabricate elbows.

C. 1. Fabricate from the following materials:

D. a. Material and Gage: ASTM A 53, Grade B, Schedule 40, galvanized.

E. b. Material and Gage: ASTM A 53, Grade B, Schedule 40, galvanized.

F. Parapet Scuppers: Fabricate scuppers to dimensions indicated on Drawings, 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.

G. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape indicated on Drawings, complete with outlet tubes, exterior flange trim, and built-in overflows. Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch thick

H. Splash Pans: Fabricate to dimensions and shape required and from the following materials:

1. Galvanized Steel: 0.028 inch thick

2.11 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch-long, but not exceeding 12-foot-long sections. Furnish with 6-inch-wide, joint cover plates. Shop fabricate interior and exterior corners.

1. Joint Style: Overlapped, 4 inches wide.

2. Fabricate with scuppers spaced 10 feet apart, to dimensions required with 4 inch-wide flanges and base extending 4 inches beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.

3. Fabricate from the Following Materials:

a. Galvanized Steel: 0.028 inch thick.

B. 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 drill elongated holes for fasteners on interior leg. Miter corners, fasten and seal watertight. Shop fabricate interior and exterior corners.

1. Coping Profile: As indicated on Drawings.
 2. Joint Style: Butted with expansion space and 6-inch-wide, concealed backup plate
 3. Fabricate from the Following Materials:
 - a. Pre-Finished Aluminum: 0.063 inch thick.
 - C. Roof and Roof-to-Wall Transition Roof-to-Roof Edge-Flashing (Gravel-Stop) Transition Roof-to-Roof Edge-Flashing (Gravel-Stop) and Fascia-Cap Transition Expansion-Joint Cover: Fabricate from the following materials: Shop fabricate interior and exterior corners.
 1. Galvanized Steel: 0.034 inch thick.
 - D. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
 1. Galvanized Steel: 0.028 inch thick.
 - E. Flashing Receivers: Fabricate from the following materials:
 1. Galvanized Steel: 0.028 inch thick.
 - F. Roof-Penetration Flashing: Fabricate from the following materials:
 1. Galvanized Steel: 0.028 inch thick.
 - G. Roof-Drain Flashing: Fabricate from the following materials:
 1. Copper: 12 oz./sq. ft..
- 2.12 WALL SHEET METAL FABRICATIONS
- A. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2 inch-high, end dams. Fabricate from the following materials:
 1. Galvanized Steel: 0.028 inch thick.
 - B. Wall Expansion-Joint Cover: Fabricate from the following materials:
 1. Galvanized Steel: 0.028 inch thick.
- 2.13 MISCELLANEOUS SHEET METAL FABRICATIONS
- A. Equipment Support Flashing: Fabricate from the following materials:
 1. Galvanized Steel: 0.028 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.
 1. Verify compliance with requirements for installation tolerances of substrates.
 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. General: 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. Synthetic Underlayment: Install synthetic underlayment, wrinkle free, according to manufacturers' written instructions, and using adhesive where possible to minimize use of mechanical fasteners under sheet metal.
- C. 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.
- D.

3.3 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 3. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
 - 4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
 - 5. Install sealant tape where indicated.
 - 6. Torch cutting of sheet metal flashing and trim is not permitted.
 - 7. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
 - 1. Coat back side of uncoated aluminum sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.
- C. Seal joints as shown and as required for watertight construction.
 - 1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for

installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.

2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

- D. 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
- E. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- F. 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.
- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets with solder to width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work.
 1. Do not solder metallic-coated steel sheet.
 2. Do not use torches for soldering.
 3. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.4 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. Hanging Gutters: Join sections with riveted and soldered joints or joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchor them in position. Provide end closures and seal watertight with sealant. Slope to downspouts.
 1. Fasten gutter spacers to front and back of gutter.
 2. Anchor and loosely lock back edge of gutter to continuous cleat.
 3. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24 inches apart.
 4. Anchor gutter with gutter brackets spaced not more than 24 inches apart to roof deck, unless otherwise indicated, and loosely lock to front gutter bead.
 5. Install gutter with expansion joints at locations indicated, but not exceeding, 50 feet apart. Install expansion-joint caps.
 6. Install continuous gutter screens on gutters with noncorrosive fasteners, removable for cleaning gutters.
- C. Downspouts: Join sections with 1-1/2-inch telescoping joints.
 1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c.
 2. Provide elbows at base of downspout to direct water away from building.
- D. Splash Pans: Install where downspouts discharge on low-slope roofs. Set in [or] elastomeric sealant compatible with the substrate.

- E. 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.
 - 1. Anchor scupper closure trim flange to exterior wall and seal with elastomeric sealant to scupper.
 - 2. Loosely lock front edge of scupper with conductor head.
 - 3. Seal with elastomeric sealant exterior wall scupper flanges into back of conductor head.
- F. Conductor Heads: Anchor securely to wall, with elevation of conductor head rim at minimum of 1 inch below scupper or gutter discharge.
- G. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints minimum of 4 inches in direction of water flow.

3.5 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 at staggered 3-inch centers.
- C. Copings: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated.
 - 1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 16-inch centers.
 - 2. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch centers.
- 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. Secure in waterproof manner by means of snap-in installation and sealant unless otherwise indicated.
- F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.6 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. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.7 MISCELLANEOUS FLASHING INSTALLATION

- A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.8 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.9 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.
- E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

SECTION 077100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Copings.
 - 2. Roof-edge drainage systems.
 - 3. Reglets and counterflashings.

1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. 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.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For roof specialties. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work. Include the following:
 - 1. Details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
 - 2. Pattern of seams and layout of fasteners, cleats, clips, and other attachments.
 - 3. Details of termination points and assemblies, including fixed points.
 - 4. Details of special conditions.
- C. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.
- D. Samples for Verification: For copings roof-edge drainage systems reglets and counterflashings made from 12-inch lengths of full-size components including fasteners, cover joints, accessories, and attachments.

1.5 CLOSEOUT SUBMITTALS

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

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.
- B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof specialties installation.

PART 2 - PRODUCTS

2.1 EXPOSED METALS

- A. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
- B. Surface: Smooth, flat finish.
 - 1. Exposed Coil-Coated Finishes: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Concealed Surface: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.
 - 2. Clear Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
- C. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:
 - 1. Exposed High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Clear Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
- D. Coated Galvanized Steel Sheet: 0.063 inch, AISI-G90, alloy as standard with manufacturer for finish required, primed and coated on one side, with temper as required to suit forming operations and performance required.
 - 1. Surface: Smooth, flat.
 - 2. PVDF coating, PPG Duranar or equal, complying with AAMA 605.2-92, consisting of 70% Kynar 500/Hylar 5000 fluoropolymer resin coating 1.0 mil total dry film thickness. Color selected by Architect from full range of standard and exotic colors.

2.2 CONCEALED METALS

- A. Aluminum Sheet: ASTM B 209, alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.
- B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.
- C. Coated Galvanized Steel Sheet: 0.063 inch, AISI-G90, alloy as standard with manufacturer for finish required, primed and coated on one side, with temper as required to suit forming operations and performance required.

2.3 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
 - 1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
 - 2. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
 - 3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
 - 4. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.
- C. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.4 COPINGS

- A. Copings: Manufactured coping system consisting of formed-metal coping cap in section lengths not exceeding 12 feet, concealed anchorage; corner units, end cap units, and concealed splice plates with same finish as coping caps.
 - 1. Coping-Cap Material: aluminum, 0.063 inch thick.
 - a. Finish: PVDF coating, PPG Duranar or equal, complying with AAMA 605.2-92, consisting of 70% Kynar 500/Hylar 5000 fluoropolymer resin coating 1.0 mil total dry film thickness. Color selected by Architect from full range of standard and exotic colors.
 - 2. Corners: Factory mitered and soldered .
 - 3. Special Fabrications: Radiused sections.
 - 4. Coping-Cap Attachment Method: Face leg hooked to continuous cleat with back leg fastener exposed, fabricated from coping-cap material.
 - 5. Face Leg Cleats: Concealed, continuous galvanized-steel sheet.

2.5 ROOF-EDGE DRAINAGE SYSTEMS

- A. Gutters: Manufactured in uniform section lengths not exceeding 12 feet, with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch ()above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.
 - 1. Fabricate from the following exposed metal:
 - a. Formed Aluminum: 0.050 inchthick.
 - 2. Gutter Profile: As indicated according to SMACNA's "Architectural Sheet Metal Manual."
 - 3. Corners: Factory mitered and soldered .
 - 4. Gutter Supports: Gutter brackets with finish matching the gutters.
 - 5. Gutter Accessories: Wire ball downspout strainer.
- B. Downspouts: Plain round complete with elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
 - 1. Extruded Aluminum: 0.125 inch thick.
- C. Parapet Scuppers: Manufactured 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.
 - 1. Fabricate from the following exposed metal:
 - a. Formed Aluminum: 0.032 inch thick.

- D. Conductor Heads: Manufactured conductor heads, each with flanged back and stiffened top edge and of dimensions and shape indicated, complete with outlet tube that nests into upper end of downspout, exterior flange trim, and built-in overflow.
 - 1. Fabricate from the following exposed metal:
 - a. Formed Aluminum: 0.032 inch thick.
- E. Splash Pans: Fabricate from the following exposed metal:
 - 1. Formed Aluminum: 0.040 inch thick.
- F. Aluminum Finish: Clear anodic.

2.6 REGLETS AND COUNTERFLASHINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Fry Reglet Corporation.
 - 2. or Equal.
- B. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:
 - 1. Formed Aluminum: Type MA, 0.050 inch thick.
- C. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches and in lengths not exceeding 12 feet designed to snap into reglets or through-wall-flashing receiver and compress against base flashings with joints lapped, from the following exposed metal:
 - 1. Formed Aluminum: 0.032 inch thick.
- D. Aluminum Finish: Clear anodic.

2.7 ACCESSORIES

- A. Fasteners: Galvanized steel with soft neoprene washers at exposed fasteners. Finish exposed fasteners same as flashing metal.
- B. Sealant: Type specified in Section 079200.
- C. Solder: ANSI/ASTM B 32; type with less than 0.2% lead.
- D. Flux: FS O-F-506.
- E. Provide water resistant underlayment per Section 092400.
- F. Provide elastomeric flashing per Section 071353.

2.8 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 and painted 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.
- C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete roof-specialty systems.
 - 1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
 - 2. Provide uniform, neat seams with minimum exposure of solder and sealant.
 - 3. Install roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
 - 4. Torch cutting of roof specialties is not permitted.
 - 5. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of uncoated aluminum roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
- C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
 - 1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise shown on Drawings.
 - 2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
- D. Fastener Sizes: Use fasteners of sizes that will penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Seal joints as required for watertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.

3.3 COPING INSTALLATION

- A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Install coping with cleats and clips as specified and as shown on drawings. Provide continuous cleat at exterior surface. Provide approved fasteners at inside (roof) surface at 24 inches on center.

- C. Provide waterproof underlayment over wall framing and under coping flashing. Provide elastomeric flashing at all coping joints, extending 12 inches each side of joint. Coordinate with plaster underlayment installation.

3.4 ROOF-EDGE DRAINAGE-SYSTEM INSTALLATION

- A. General: Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.
- B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 12 inches apart. Attach ends with rivets and seal with sealant to make watertight. Slope to downspouts.
 - 1. Install gutter with expansion joints at locations indicated but not exceeding 50 feet () apart. Install expansion joint caps.
 - 2. Connect downspouts to downspout boots and seal connection.
 - 3. SMACNA Reference: Hanging Gutter Installations-Sloped Roofs, Figure 119B, with minimum 4 inch flashing flange beneath roof flashing system.
 - 4. SMACNA Reference: Hanging Gutter Installations-Sloped Roofs, Figure 119A, with minimum 4 inch flashing flange beneath roof flashing system.
 - 5. SMACNA Reference: Concealed Hanging Gutters, Figure 1-15C, with minimum 4 inch flashing flange beneath roof flashing system.
 - 6. Provide downspout connection per SMACNA Figure 1-33, with basket strainer.
- C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c.
 - 1. Provide elbows at base of downspout to direct water away from building.
- D. Splash Pans: Install where downspouts discharge.
- E. Parapet Scuppers: Install scuppers through parapet where indicated. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
 - 1. Anchor scupper closure trim flange to exterior wall and seal or solder to scupper.
 - 2. Loosely lock front edge of scupper with conductor head.
 - 3. Seal or solder exterior wall scupper flanges into back of conductor head.
- F. Conductor Heads: Anchor securely to wall with elevation of conductor top edge 1 inch () below scupper gutter discharge.

3.5 REGLET AND COUNTERFLASHING INSTALLATION

- A. General: Coordinate installation of reglets and counterflashings with installation of base flashings.
- B. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches over top edge of base flashings.
- C. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches and bed with elastomeric sealant. Fit counterflashings tightly to base flashings.

3.6 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.
- D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077100

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Roof hatches.
 - 2. Hatch-type heat and smoke vents.
 - 3. Preformed flashing sleeves.

1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For roof accessories. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.
- C. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
 - 1. Size and location of roof accessories specified in this Section.
 - 2. Method of attaching roof accessories to roof or building structure.
 - 3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
 - 4. Required clearances.
- B. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.7 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

- B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

PART 2 - PRODUCTS

2.1 METAL MATERIALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 ()coating designation.
 - 1. 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 1 mil for topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils ().

2.2 ROOF HATCH

- A. Roof Hatches: Metal roof-hatch units with lids and insulated single -walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, and integrally formed deck-mounting flange at perimeter bottom.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Bilco; Type S-20n or comparable product by one of the following:
 - a. Bilco Company (The).
 - b. J. L. Industries, Inc.
 - c. Nystrom.
 - d. or Equal.
- B. Type and Size: Single-leaf lid, 30 by 36 inches.
- C. Hatch Material: Zinc-coated (galvanized) steel sheet, thick.
 - 1. Finish: Baked enamel or powder coat .
 - 2. Color: As selected by Architect from manufacturer's full range.
- D. Construction:
 - 1. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
 - 2. Fabricate curbs to minimum height of 12 inches unless otherwise indicated.
 - 3. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is tapered to accommodate roof slope so that top surfaces of perimeter curb are level. Equip hatch with water diverter or cricket on side that obstructs water flow.
- E. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.
 - 1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
 - 2. Height: 42 inches above finished roof deck.
 - 3. Post: 1-5/8-inch- diameter pipe.
 - 4. Finish: Manufacturer's standard baked enamel or powder coat.

2.3 PREFORMED FLASHING SLEEVES

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:
 - a. SBC Industries, www.sbcflashings.com, 800-228-2580.

2. Products:
 - a. Flashings for Pipes, Structural Members & Conduits: Stainless steel, ASTM A 240 type 304, 2B finish, 26 gauge. 2-piece divide. (Model PL/D and SQT/D)

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- C. Verify dimensions of roof openings for roof accessories.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install roof accessories according to manufacturer's written instructions.
 1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
 2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
 3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
 4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
- C. Roof Curb Installation: Install each roof curb so top surface is level.
- D. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.
- E. Roof-Hatch Installation:
 1. Install roof hatch so top surface of hatch curb is level.
 2. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
 3. Attach ladder-assist post according to manufacturer's written instructions.
- F. Heat and Smoke Vent Installation:
 1. Install heat and smoke vent so top perimeter surfaces are level.
 2. Install and test heat and smoke vents and their components for proper operation according to NFPA 204.

- G. Pipe Support Installation: Install pipe supports so top surfaces are in contact with and provide equally distributed support along length of supported item.
- H. Preformed Flashing-Sleeve Installation: Secure flashing sleeve to roof membrane according to flashing-sleeve manufacturer's written instructions.

3.3 REPAIR AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780.
- B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- C. Clean exposed surfaces according to manufacturer's written instructions.
- D. Clean off excess sealants.
- E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200

SECTION 078413 - PENETRATION FIRESTOPPING

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. Penetrations in fire-resistance-rated walls.
 - 2. Duct, cable, conduit, and piping penetrations through fire-resistive ceiling, floor and wall assemblies.
 - 3. Penetrations of fire resistive vertical service shafts, including annular space at duct penetrations.
 - 4. Gaps, separations, and openings resulting from construction and penetrations in fire-resistive ceiling, floor and wall assemblies, including the intersection of such components.
 - 5. Additional locations where specifically shown on the Drawings or where specified in other Sections of the Project Manual.

1.3 PERFORMANCE REQUIREMENTS

- A. System materials and installation shall provide a through penetration or membrane penetration with a fire resistance rating equal to that of the assembly penetrated, based on ASTM E 119 and ASTM E 814 testing methods, and in compliance with referenced regulations.
 - 1. Use of exceptions based on size of penetrating items as defined by CBC Chapter 7 is not acceptable. Firestop all penetrations, regardless of size, with material complying with specified criteria.
 - 2. System shall comply with performance criteria and characteristics as specified in this Section.

1.4 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.

1.5 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.

- D. Provide agency approval documentation, including ICC ES reports, State Fire Marshal Listing, or other approvals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.
- 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."

1.7 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.

1.8 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:
 - 1. 3M Fire Protection Products.
 - 2. Tremco, Inc.; Tremco Fire Protection Systems Group.
 - 3. USG Corporation.

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. Fire-resistance-rated walls include fire walls fire-barrier walls smoke-barrier walls and fire partitions.
- C. Standards and Regulatory Criteria:
 - 1. Provide systems listed under categories XHCR and XHEZ in UL Fire Resistance Directory, current edition or approved equivalent.
 - 2. Provide systems providing fire resistance ratings in compliance with Part 2, Title 24, CCR, including the following Sections:
 - a. Walls and Partitions: Sections 706, 708 and 714.
 - b. Floor Ceilings or Roof Ceilings: Sections 706, 711 and 714.
 - c. Vertical Fire Spread at Exterior Walls: Sections 706 and 709. Shaft Enclosures: Section 706.3.1 and 707.
 - d. Fire Resistive Joint Systems: Section 706.9 and 713.
 - e. Penetrations: Section 712.
 - 3. Test Standards: Test firestopping systems in accordance with the following:
 - a. ASTM E 84.- Test Method for Surface Burning Characteristics of Building Materials.
 - b. ASTM E 119 - Method for Fire Tests of Building Construction and Materials.
 - c. ASTM E 814 - Test Method of Fire Tests of Through Penetration Firestops.
 - d. UBC Standard 7-5, Fire Tests of Through - Penetration Firestops.
 - 4. Performance Characteristics:
 - a. Cold Smoke Barrier: Provide system with sealant component capable of preventing cold smoke penetration through firestopping.
 - b. Assembly Construction: In non-symmetrical wall assemblies, select system based on least fire-resistive side.
 - c. Movement Capability:
 - 1) Provide system with sufficient resiliency and elastomeric properties to accommodate anticipated thermal movements of penetrating item without compromising firestopping function.
 - 2) Provide system with sufficient resiliency and elastomeric properties to accommodate anticipated vibration and cyclic movement of penetrating item without compromising firestopping function.
 - d. Habitability:
 - 1) For applications within or adjacent to occupied spaces, provide system with maximum 10 g/l VOC content, and without objectionable odor or harmful fumes. Comply with Section 015000.
 - 2) Do not utilize systems generating explosive or flammable gas, including hydrogen, during installation or curing.
 - 3) Provide systems without asbestos containing materials, including safing and damming materials.

- 4) Provide material with flow characteristics resulting in smooth, non-sag joints.
- 5) Where floor joint dimension between penetrating item and edge of firestop exceeds three inches, and firestopping is unprotected, provide firestopping system components with sufficient load bearing capacity to withstand floor loading criteria.
- e. Compatibility:
 - 1) Verify compatibility of selected system with substrate and penetrating item.
 - 2) Do not use systems with materials that stain or bleed into substrate or deposit films on surface of firestopping.
 - 3) At insulated piping applications, select systems that do not require removal of insulation materials.
- f. Fire Safety:
 - 1) Flame Spread: Maximum value of 25 per ASTM E 84.
 - 2) Smoke Contributed: Maximum value of 50 per ASTM E 84.
 - 3) Damming Materials: Provide non-combustible damming materials for permanent installation conditions.
 - 4) Where T ratings are required in corridor and floor conditions, select system providing maximum flexibility for type and size of penetrating item.
- D. 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.
- E. Low-Emitting Materials: Penetration firestopping sealants and sealant primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- F. 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 qualifies testing and inspecting agency for firestopping indicated.

2.3 FIRE SAFING

- A. Fire Safing
 1. Manufacturer: Thermafiber, Inc., which is located at: 3711 Mill St. ; Wabash, IN 46992; Toll Free Tel: 888-834-2371; Tel: 260-563-2111; Fax: 260-563-8979; Email: [requestinfo](mailto:requestinfo@thermafiber.com); Web: www.thermafiber.com
 2. Type: Thermafiber Safing.
 3. Facing: Unfaced.
 4. Density: 4.0 pcf (nominal).
 5. Thickness: 4 inches.
 6. Surface-Burning Characteristics: ASTM E 84. Unfaced material will have a maximum flame spread 0 and smoke-developed of 0.

2.4 DUCT PENETRATION FIRE BLOCKING

- A. Fire Safing
 1. Manufacturer: Thermafiber, Inc., which is located at: 3711 Mill St. ; Wabash, IN 46992; Toll Free Tel: 888-834-2371; Tel: 260-563-2111; Fax: 260-563-8979; Email: [requestinfo](mailto:requestinfo@thermafiber.com); Web: www.thermafiber.com
 2. Type: Thermafiber Safing.

3. Facing: Unfaced.
 4. Density: 4.0 pcf (nominal).
 5. Thickness: 4 inches.
 6. Surface-Burning Characteristics: ASTM E 84. Unfaced material will have a maximum flame spread 0 and smoke-developed of 0.
- B. Firestop Sealant
1. Manufacturer: Hilti, Inc. 5400 South 122nd East Avenue, Tulsa, OK 74146, 800-879-8000.
 2. Type: CP 604 Self-leveling firestop sealant.
 3. Thickness: 1 inch minimum applied over top of fire safing.
- C. Standards Compliance
- D. ASTM E 814, UL 1479 and UL 2079.

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 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 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.
- C. Retain first paragraph below if Intertek ETL SEMKO-listed systems are required.

END OF SECTION 078413

SECTION 079200 - JOINT SEALANTS

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. Sealants and joint treatment necessary to provide a positive barrier against passage of moisture and air.
 - 2. Sealants at all penetrations of sound rated walls and floors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. 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.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
- D. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

1.6 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.

1.7 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.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Elastomeric Sealant Standard: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant in the Elastomeric Joint-Sealant Schedule at the end of Part 3, including those referencing ASTM C 920 classifications for type, grade, class, and uses.
- C. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- D. Sealants shall comply with the testing and product requirements of San Diego Air Pollution Control District Rule 67.0 "Architectural Coatings" and Rule 67.21 "Adhesive Material Application Operations".
- E. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food; provide products that comply with 21 CFR 177.2600.
- F. 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.
 1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- G. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.
- H. In concealed installations, and in partially or fully exposed installations where approved by the Architect, use standard gray sealant.

2.2 SEALANTS

- A. General:
 1. All sealants for any one Type shall be the product of a single manufacturer, suitable for the intended use, and per the following product characteristics.
 2. Unless noted otherwise, use sealants in application as defined below.

3. For other applications provide products especially formulated for the proposed use and approved in advance by the Architect.

B. Product Characteristics:

1. Type 1: Unless noted otherwise, at exterior openings, joints, material transitions, bedding, and other conditions where anticipated joint movement will be plus/minus 25% or less.
 - a. Products: DOWSIL 795, Pecora 895, Tremco Tremsil 600, or equal.
2. Type 2: At all exposed metal to metal wall and roof flashing conditions, all exposed prefinished metal roofing and flashing conditions; storefront perimeter conditions, and all other conditions where anticipated joint movement will be plus/minus 25 - 50%.
 - a. Products: DOWSIL 795, GE Silicones Silglaze II, or equal.
3. Type 3: At horizontal concrete paving joints exposed to pedestrian and vehicular traffic, and all joints subject to immersion:
 - a. Products: Pecora DynaTred, Mameco Vulkem 227, Sonneborn NP2, or equal.
4. Type 4: Exterior application in conjunction with wood products:
 - a. Tremco Dymonic, Sika Sikaflex-1a, Sonneborn NP1, or equal.
5. Type 5: Pipes and conduits penetrating underground walls:
 - a. Sealant compatible with waterproofing system.
6. Type 6: Interior applications in conjunction with sanitary conditions (nonfooduse):
 - a. Products: General Electric Silicone Sanitary Sealant 1702, DOWSIL 786, Pecora 898 Sanitary Silicone Sealant, or equal.
7. Type 7: Interior sound control applications.
 - a. Products: USG Sheetrock Acoustical Sealant, Pecora AC20FTR, Tremco Acoustical Sealant, or equal.
8. Type 8: Unless noted otherwise, at interior openings, joints, material transitions and bedding, at locations shown on drawings, and other conditions where anticipated joint movement will be 25% or less.
 - a. Products: Pecora 864, DOWSIL 795, Sonneborn Omniseal, Sikaflex 1A, or equal.
9. Type 9: At all concealed prefinished metal roofing and flashing conditions, provide butyl sealant as recommended by metal roofing manufacturer.
10. Type 10: At all metal flashing and gutter joints subject to periodic or continuous water immersion:
 - a. Products: DOWSIL 799, Pecora 863, or equal.
11. Type 11: At joints in acoustical laminated glass:
 - a. Products: DOWSIL 795, Pecora 895, Tremco Tremsil 600, or equal.
12. For other applications provide products especially formulated for the proposed use and approved in advance by the Architect.

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 C (closed-cell material with a surface skin) Type O (open-cell material) Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, 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, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Unglazed surfaces of ceramic tile.
 - c. Exterior insulation and finish systems.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. 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. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.

- B. Joint Priming: Prime joint substrates. 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 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.
- E. 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.
- F. 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 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 079200

SECTION 079500 - EXPANSION CONTROL

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. Exterior wall expansion control systems.

1.3 ACTION SUBMITTALS

- A. Shop Drawings: For each expansion control system specified. Include plans, elevations, sections, details, splices, blockout requirement, attachments to other work, and line diagrams showing entire route of each expansion control system. Where expansion control systems change planes, provide isometric or clearly detailed drawing depicting how components interconnect.
- B. Samples: For each exposed expansion control system and for each color and texture specified, full width by 6 inches long in size.
- C. Samples for Initial Selection: For each type of expansion control system indicated.
 - 1. Include manufacturer's color charts showing the full range of colors and finishes available for each exposed metal and elastomeric seal material.
- D. Samples for Verification: For each type of expansion control system indicated, full width by 6 inches long in size.
- E. Product Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:
 - 1. Manufacturer and model number for each expansion control system.
 - 2. Expansion control system location cross-referenced to Drawings.
 - 3. Nominal joint width.
 - 4. Movement capability.
 - 5. Classification as thermal or seismic.
 - 6. Materials, colors, and finishes.
 - 7. Product options.
 - 8. Fire-resistance ratings.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each fire barrier provided as part of an expansion control system, for tests performed by a qualified testing agency.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. General: Provide expansion control systems of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.

1. Furnish units in longest practicable lengths to minimize field splicing. Install with hairline mitered corners where expansion control systems change direction or abut other materials.
 2. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion control systems.
- B. Coordination: Coordinate installation of exterior wall and soffit expansion control systems with roof expansion control systems to ensure that wall transitions are watertight. Roof expansion joint assemblies are specified elsewhere.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: Where indicated, provide expansion control systems with fire barriers identical to those of systems tested for fire resistance per UL 2079 or ASTM E 1966 by a testing and inspecting agency acceptable to authorities having jurisdiction.
1. Hose Stream Test: Wall-to-wall and wall-to-ceiling systems shall be subjected to hose stream testing.
- B. Seismic Performance: Expansion control systems shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

2.3 EXTERIOR EXPANSION CONTROL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following or equal:
1. Construction Specialties, Inc.
 2. MM Systems Corporation.
- B. Source Limitations: Obtain expansion control systems from single source from single manufacturer.
- C. Floor to Floor/Wall Exterior Expansion Joint - (EEJ-1):
1. Basis-of-Design Product: Construction Specialties, Inc.; SSRW-1200LS with Vapor Barrier.
 2. Design Criteria:
 - a. Nominal Joint Width: 12 inches, 8 inches clear.
 - b. Exposed Metal: Aluminum.
 - 1) Finish: mill Finish.
 - 2) Cover-Plate Design: Corrugated center pan Recessed to accept field-applied finish materials.
 - 3) Recess Depth: 2 1/2 " minimum.
 - c. Moisture Barrier: 7-ply laminate reinforced Polyethylene.
- D. Wall-to-Wall Exterior Expansion Joint - (EEJ-2):
1. Basis-of-Design Product: Construction Specialties, Inc.; XLSC2G-1200.
 2. Design Criteria:
 - a. Nominal Joint Width: 12 inches
 - b. Exposed Metal: Aluminum
 - 1) Finish: Clear Anodic, Class I.
 - c. Moisture Barrier: 7-ply laminate reinforced Polyethylene.
 - d. Pan system with 9/16" recess to have a lightweight finish applied in the field. Weight should not exceed 150 lbs. per 10' length.

- E. Factory Fabricated Transitions: all end caps, transitions and miters to be factory fabricated to ensure weather integrity. Field fabrication is not acceptable.
- F. Wall to Wall Exterior Expansion Joint - (EEJ-3):
 - 1. Basis-of-Design Product: Construction Specialties, Inc.; XLPC2G-1200.
 - 2. Design Criteria:
 - a. Nominal Joint Width: 12 inches
 - b. Exposed Metal: Aluminum
 - 1) Finish: Clear Anodic, Class I.
 - c. Cover plate thickness shall be no less than .125" thick.
 - d. Factory Fabricated Transitions: all end caps, transitions and miters to be factory fabricated to ensure weather integrity. Field fabrication is not acceptable.
- G. Telescoping Handrail system Exterior Expansion Joint - (EEJ-4):
 - 1. Basis-of-Design Product: Construction Specialties, Inc.; FGR-1200 .
 - 2. Design Criteria:
 - a. Nominal Joint Width: 12 inches
 - b. Exposed Metal: Brushed Aluminum with Clear Anodic, Class I
 - c.

2.4 ACCESSORIES

- A. Moisture Barriers: Manufacturer's standard moisture barrier consisting of a continuous, waterproof membrane within joint and attached to substrate on sides of joint below the primary cover.

2.5 MATERIALS

- A. Aluminum: ASTM B 221, Alloy 6063-T5 for extrusions; ASTM B 209, Alloy 6061-T6 for sheet and plate.
 - 1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.
- B. Stainless Steel: ASTM A 240/A 240M or ASTM A 666, Type 304 for plates, sheet, and strips.
 - 1. Remove tool and die marks and stretch lines or blend into finish.
- C. Cellular Foam Seals: Extruded, compressible foam designed to function under compression.
- D. Elastomeric Concrete: Modified epoxy or polyurethane extended into a prepackaged aggregate blend, specifically designed for bonding to concrete substrates.
- E. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to meet performance criteria for required fire-resistance rating.
- F. Moisture Barrier: Flexible elastomeric material.
- G. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
- H. Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.6 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 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.

2.7 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

2.8 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Run grain of directional finishes with long dimension of each piece.
 - 2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - 3. Directional Satin Finish: No. 4.
- C. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces where expansion control systems will be installed for installation tolerances and other conditions affecting performance of work.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to expansion control system manufacturer's written instructions.
- B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion control systems. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion control systems.

3.3 INSTALLATION

- A. Comply with manufacturer's written instructions for storing, handling, and installing expansion control systems and materials unless more stringent requirements are indicated.
- B. Foam Seals: Install with adhesive recommended by manufacturer.
- C. Terminate exposed ends of expansion control systems with field- or factory-fabricated termination devices.
- D. Moisture Barrier: Provide at all exterior joints and where indicated on Drawings. Provide drainage fittings at a maximum of 50 feet.

3.4 PROTECTION

- A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.
- B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over expansion control systems. Reinstall cover plates or seals prior to Substantial Completion of the Work.

END OF SECTION 079500

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

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 DELIVERY, STORAGE, AND HANDLING

- 1. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.
- D. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.3 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.

1.4 PROJECT CONDITIONS

1.5 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.6 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.
- B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. CECO Door Products.
 - 2. Curries Company.
 - 3. Security Metal Products.

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
 - a. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60A60 metallic coating.

2.3 STANDARD HOLLOW METAL DOORS

- A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.
- B. Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
 - 1. Design: Flush panel.
 - 2. Core Construction: Manufacturer's standard polystyrene, polyurethane, mineral core, or vertical steel-stiffener core.
 - a. Polystyrene and Polyurethane (Insulated) Doors: Where indicated, provide doors fabricated as thermal-rated assemblies with a minimum R-value 11 or better.
 - b. Standard Vertical Steel-Stiffener Core: Minimum 22 gauge steel-stiffeners at 6 inches on-center construction attached by spot welds spaced not more than 5" on centers. Spaces between stiffeners filled with fiberglass insulation (minimum density 0.8#/cubic ft.).
 - c. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
 - 3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
 - 4. Vertical Edges: Vertical edges to have the face sheets joined by a continuous weld extending the full height of the door. Welds are to be ground, filled and dressed smooth. Beveled Lock Edge, 1/8 inch in 2 inches.
 - 5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
 - 6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
 - 7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

- C. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
 - 1. Design: Flush panel.
 - 2. Core Construction: Manufacturer's standard one-piece polystyrene core, securely bonded to both faces.
 - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
 - 3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
 - 4. Vertical Edges: Vertical edges to have the face sheets joined by a continuous weld extending the full height of the door. Welds are to be ground, filled and dressed smooth. Beveled Lock Edge, 1/8 inch in 2 inches.
 - 5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
 - 6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
 - 7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- D. Manufacturers Basis of Design:
 - 1. CECO Door Products (C): Legion Series, Trio E.
 - 2. Curries Company (CU): 707 Series, 777 Trio E.
 - 3. Security Metal Products.

2.4 STANDARD HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.
- C. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.5 ENERGY EFFICIENCY HOLLOW METAL FRAMES

- A. Weatherstripped Frames: Subject to the same compliance standards and requirements as standard hollow metal frames, provide where indicated weatherstripped profiles with 1/8" integral kerf formed into the frame soffit able to receive manufacturer's listed gasket material. Available for use in both masonry and drywall construction, with fire rating up to 3 hours complying with NFPA 105, UL 1784, and ASTM E-283 Test criteria.
 - 1. Manufacturers Basis of Design:
 - a. CECO Door Products - Weatherstripped SQW Series.
 - b. CECO Door Products - Weatherstripped SRW Series.
 - c. Curries Company - Weatherstripped WC Series.
 - d. Curries Company - Weatherstripped WM Series.
- B. Security Metal Products.

2.6 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Stud Wall Type: Designed to engage stud and not less than 0.042 inchthick.
 - 2. Floor Anchors: Floor anchors to be provided at each jamb, formed from metallic coated material, not less than 0.042 inches thick.
- B. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.7 LOUVERS

- A. Metal Louvers: Door manufacturer's standard metal louvers unless otherwise indicated.
 - 1. Blade Type: Vision proof inverted V or inverted Y.
 - 2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.
- B. Louvers for Fire Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire protection rating of 1-1/2 hours and less.
 - 1. Manufacturers: Subject to compliance with requirements, provide door manufacturers standard louver to meet rating indicated.
 - 2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

2.8 LIGHT OPENINGS AND GLAZING

- A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricators shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.
- B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.
- C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames
- D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.
- E. Glazing: Comply with requirements in Division 08 Section "Glazing" and with the hollow metal door manufacturer's written instructions.
 - 1. Factory Glazing: Factory install glazing in doors as indicated. Doors with factory installed glass to include all of the required glazing material.

2.9 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.10 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.
- C. Hollow Metal Doors:
 - 1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
 - 2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
 - 3. Louvers: Factory cut openings in door and install louvers into prepared openings where indicated.
 - 4. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" 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.
 - 5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
 - 6. Electrical Raceways: Provide hollow metal doors to receive electrified hardware with concealed wiring harness and standardized Molex™ plug connectors on both ends to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electrified hardware and the through-wire transfer hardware or wiring harness specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware". Wire nut connections are not acceptable.
- D. Hollow Metal Frames:
- E. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 - a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
 - 2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 - 3. Equal Rabbet Frames: Provide frames with equal rabbet dimensions unless glazing and removable stops require wider dimensions on glass side of frame.
 - 4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
 - 5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
 - 6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.

7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
 8. Electrical Thru-Wiring: Provide hollow metal frames receiving electrified hardware with loose wiring harness (not attached to open throat components or installed in closed mullion tubes) and standardized Molex™ plug connectors on one end to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electric through-wire transfer hardware or wiring harness specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware".
 9. Electrical Knock Out Boxes: Factory weld 18 gauge electrical knock out boxes to frame for electrical hardware preps; including but not limited to, electric through wire transfer hardware, electrical raceways and wiring harnesses, door position switches, electric strikes, magnetic locks, and jamb mounted card readers as specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware".
 - a. Provide electrical knock out boxes with a dual 1/2-inch and 3/4-inch knockouts.
 10. Conduit to be coordinated and installed in the field (Division 26) from middle hinge box and strike box to door position box.
 - a. Electrical knock out boxes to comply with NFPA requirements and fit electrical door hardware as specified in hardware sets in Division 08 Section "Door Hardware".
 - b. Electrical knock out boxes for continuous hinges should be located in the center of the vertical dimension on the hinge jamb.
 11. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 12. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 13. Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
 - a. Severe Storm Shelter Openings: Provide jamb, head, and sill anchors in accordance with manufacturer's tested and approved assemblies.
 14. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
 15. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.
- F. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.

2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.11 STEEL FINISHES

- A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.
 1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.
- B. Factory Pre-Finishes: Factory apply electrostatic paint finish to doors and frames in accordance with ANSI A250.3 test procedure acceptance criteria for steel doors and frames with factory applied finished coatings.

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. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness.
- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.

- a. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. 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 post-installed expansion anchors.
 - 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
 - a. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.
 - C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/16 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 - D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.
- 3.4 ADJUSTING AND CLEANING
- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
 - B. Remove grout and other bonding material from hollow metal work immediately after installation.
 - C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

END OF SECTION 081113

SECTION 081416 - WOOD DOORS

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. Solid-core doors with wood-veneer faces.
 - 2. Factory finishing wood doors.

1.3 SUBMITTALS

- A. Product Data: For each type of door indicated. Include details of core and edge construction, **louvers**, trim for openings, and WDMA I.S.1-A or AWS classifications.
- B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the wood door supplier in order to prepare the doors and frames to receive the finish hardware items.
- C. 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. Indicate dimensions and locations of mortises and holes for hardware.
 - 2. Indicate dimensions and locations of cutouts.
 - 3. Indicate requirements for veneer matching.
 - 4. Indicate doors to be factory finished and finish requirements.
 - 5. Indicate fire protection ratings for fire rated doors.
- D. Samples for Initial Selection: For factory finished doors.
 - 1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.
 - 2. Corner sections of doors, 8 by 10 inches, with door faces and edges representing actual materials to be used.
 - a. Provide samples for each species of veneer and solid lumber required.
 - b. Finish veneer faced door samples with same materials proposed for factory finished doors.
 - 3. Frames for light openings, 6 inches long, for each material, type, and finish required.
- E. Informational Submittals:
 - 1. Submit manufacturer's environmental documentation and applicable sustainability program credits that are available to contribute towards a LEED rated project certification.
- F. Warranty: Sample of special warranties.

1.4 QUALITY ASSURANCE

- A. **Manufacturer Qualifications:** A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- B. **Source Limitations:** Obtain flush wood doors from single manufacturer.
- C. **Quality Standard:** In addition to requirements specified, comply with WI's "Manual of Millwork."
 - 1. Provide WI-Certified Compliance Certificate indicating that doors comply with requirements of grades specified.
 - 2. Provide WI-Certified Compliance Certificate for installation.
- D. **Fire-Rated Wood Doors:** Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency.
 - 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.

1.5 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 bottom rail with opening number used on Shop Drawings.

1.6 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.

1.7 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. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following or equal:
 - 1. Graham; an Assa Abloy Group company, PC, PC5.
 - 2. Marshfield Door Systems, Inc., Durable Door.

2.2 DOOR CONSTRUCTION, GENERAL

- A. Certified Wood: Fabricate doors with all wood products produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
- B. Low-Emitting Materials: Fabricate doors with adhesives and composite wood products that do not contain urea formaldehyde.
- C. Low-Emitting Materials: Fabricate doors with adhesives and composite wood products that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.
- E. WDMA I.S.1-A Performance Grade:
 - 1. Extra Heavy Duty unless otherwise indicated.
- F. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
 - 1. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
 - 2. 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.

2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Solid-Core Doors :
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Marshfield DoorSystems; "Durable Door"
 - 2. Species: Select white birch.
 - 3. Construction: WI-7 Ply Construction.
 - a. Standards: WDMA I. S. 1-A Premium Series and Premium Grade per WI Section 12.
 - b. Adhesive: WI Type I, waterproof, formaldehyde free.
 - c. Core: Mat formed particle board conforming to ANSI A208.1-1L1. Edge Bands: Hardwood matching veneer species, without finger joints, minimum 3/4 inch thick over hardwood stiles.
 - 4. Acoustical Rating: STC 31
 - 5. Cut: Plain sliced (flat sliced).
 - 6. Match between Veneer Leaves: Book match.
 - 7. Assembly of Veneer Leaves on Door Faces: Balance match.
 - 8. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
 - 9. Exposed Vertical Edges: Same species as faces.
 - 10. WDMA I.S.1-A Performance Grade: Extra Heavy Duty .
 - 11. Vision Glass Frame: Anemostat or equal, Series FGS-75, factory primed and finish painted per Section 099123. Refer to Section 088000 for glazing.

2.4 LOUVERS AND LIGHT FRAMES

- A. Metal Louvers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:
 - a. Anemostat; a Mestek company.
 2. Blade Type: Vision-proof, inverted V .
 3. Metal and Finish: Extruded aluminum with Class II, clear anodic finish, AA-M12C22A31.
- B. Louvers for Fire-Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire-protection rating of 1-1/2 hours and less.
1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. Anemostat; a Mestek company.
 2. Metal and Finish: Hot-dip galvanized steel, 0.040 inch thick, with baked-enamel- or powder-coated finish.

2.5 FABRICATION

- A. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
1. Fabricate door and transom panels with full-width, solid-lumber, **rabbeted**, meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.
- B. Openings: Cut and trim openings through doors in factory.
1. Light Openings: Trim openings with moldings of material and profile indicated.
 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."
 3. Louvers: Factory install louvers in prepared openings.
- C. Exterior Doors: Factory treat exterior doors with water repellent after fabrication has been completed but before factory finishing.

2.6 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
1. Finish faces, all six edges.
- B. Finish doors at factory.
- C. Use only paints and coatings that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Transparent Finish:
1. Grade: Premium.
 2. Finish: Manufacturer's standard UV cured polyurethane, equal to WDMA TR-6 catalyzed polyurethane.
 3. Staining: As selected by Architect from manufacturer's full range.
 4. Sheen: Satin.

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 Section 087100 "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.
- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
 - 1. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
 - 2. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.
- D. 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 083113 - ACCESS DOORS AND FRAMES

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. Access doors and frames for walls and ceilings.
 - 2. Fire-rated access doors and frames for walls and ceilings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, fire ratings, materials, individual components and profiles, and finishes.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Detail fabrication and installation of access doors and frames for each type of substrate.
- C. Samples: For each door face material, at least 3 by 5 inches in size, in specified finish.
- D. Product Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

1.4 COORDINATION

- A. Verification: Confirm specific locations and sizes for access doors needed to gain access to concealed equipment.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics according to the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically.
 - 2. NFPA 288 for fire-rated access door assemblies installed horizontally.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Elmdor / Stoneman Manufacturing Company.
 - 2. Karp
 - 3. Milcor; Commercial Products Group of Hart & Cooley, Inc.
 - 4. Nystrom, Inc.
 - 5. Or Equal.

- B. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.
- C. Flush Access Doors with Exposed Flanges:
1. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
 2. Locations: Wall and ceiling.
 - a. Provide at all locations necessary to access all electrical components, valves, controls, damper resetting mechanisms, and other components requiring maintenance, inspection, adjustment, or reset.
 - b.
 3. Door Size: Provide panels of such size as necessary to remove largest single component requiring maintenance or replacement. Unless noted otherwise on drawings, provide minimum 18 x 18 inches square panel size at all other applications.
 4. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage.
 - a. Finish: Factory prime.
 5. Stainless-Steel Sheet for Door: Nominal 0.062 inch, @16 gage. At all janitor, laundry, toilet rooms, locker rooms and shower rooms.
 - a. Finish: Stainless Steel No. 4.
 6. Frame Material: Same material, thickness, and finish as door.
 7. Hinges: Continuous Type.
 8. Hardware: Lock.
- D. Exterior Flush Access Doors:
1. Assembly Description: Fabricate door to be weatherproof and fit flush to frame. Provide manufacturer's standard 2-inch-thick fiberglass insulation and extruded door gaskets. Provide manufacturer's standard-width frame for surface mounting, proportional to door size.
 2. Locations: Wall and Ceiling.
 - a. Provide at all locations necessary to access all electrical components, valves, controls, damper resetting mechanisms, and other components requiring maintenance, inspection, adjustment, or reset.
 - 3.
 4. Door Size: Provide panels of such size as necessary to remove largest single component requiring maintenance or replacement. Unless noted otherwise on drawings, provide minimum 18 x 18 inches square panel size at all other applications.
 5. Stainless-Steel Sheet for Door: Nominal 0.062 inch, 16 gage.
 - a. Finish: No. 4.
 6. Frame Material: Same material, thickness, and finish as door.
 7. Hinges: Continuous Type.
 8. Hardware: Lock.
- E. Fire-Rated, Flush Access Doors with Exposed Flanges:
1. Assembly Description: Fabricate door to fit flush to frame. Provide self-latching door with automatic closer and interior latch release. Provide manufacturer's standard-width exposed flange, proportional to door size.
 2. Locations: Wall and Ceiling.
 - a. Provide at all locations necessary to access all electrical components, valves, controls, damper resetting mechanisms, and other components requiring maintenance, inspection, adjustment, or reset.
 - 3.

4. Door Size: Provide panels of such size as necessary to remove largest single component requiring maintenance or replacement. Unless noted otherwise on drawings, provide minimum 18 x 18 inches square panel size at all other applications.
5. Fire-Resistance Rating: Not less than that of adjacent construction.
6. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage.
 - a. Finish: Factory prime.
7. Stainless-Steel Sheet for Door: Nominal 0.062 inch, @16 gage. At all janitor, laundry, toilet rooms, locker rooms and shower rooms.
 - a. Finish: Stainless Steel No. 4.
8. Frame Material: Same material, thickness, and finish as door.
9. Hinges: Continuous Type.
10. Hardware: Lock.

F. Hardware:

1. Lock: Cylinder.

2.3 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.
- D. Rolled-Stainless-Steel Floor Plate: ASTM A 793, manufacturer's standard finish.
- E. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 316. Remove tool and die marks and stretch lines or blend into finish.
- F. Frame Anchors: Same type as door face.
- G. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.4 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.
 1. Provide mounting holes in frames for attachment of units to metal or wood framing.
 2. Provide mounting holes in frame for attachment of masonry anchors.
- D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.
- E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

1. For cylinder locks, furnish two keys per lock and key all locks alike.

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. Steel and Metallic-Coated-Steel Finishes:
 1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
- E. Stainless-Steel Finishes:
 1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
 2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. Run grain of directional finishes with long dimension of each piece.
 - b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - c. Directional Satin Finish: No. 4.
 3. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

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.
- B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083113

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

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. Aluminum storefront framing.
 - 2. Aluminum windows.

1.3 REFERENCES

- A. ANSI/ASTM A 36 - Structural Steel.
- B. ASTM A 167 - Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
- C. ASTM A 653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvanized) by the Hot-Dip Process.
- D. ANSI/ASTM B 221 - Aluminum and Aluminum-Alloy Extruded Bar, Rod, Wire, Profiles, and Tube.
- E. ASTM B 209 - Aluminum and Aluminum-Alloy Sheet and Plate.
- F. ASTM E 283 - Test Method for Determining the Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences Across the Specimen
- G. ASTM E 330 - Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference
- H. ASTM E 331 - Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference
- I. FS TT-P-645 - Primer, Paint, Zinc Chromate, Alkyd Type.

- 1.4 Basic design criteria shall be in accordance with provisions of Title 24, CCR, and basic engineering criteria established on structural drawings.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, finishes and door hardware requirements for aluminum-framed systems.
- B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
 - 2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum
 - 3. framed entrances and storefronts, showing the following:
 - 4.
 - 5. a. Joinery, including concealed welds.

- 6. b. Anchorage.
 - 7. c. Expansion provisions.
 - 8. d. Glazing.
 - 9. e. Flashing and drainage
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- E. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum-framed systems, made from 12-inch lengths of full-size components and showing details of the following:
- 1. Joinery, including concealed welds.
 - 2. Anchorage.
 - 3. Expansion provisions.
 - 4. Glazing.
 - 5. Flashing and drainage.
- F. Other Action Submittals:
- 1.6 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For qualified Installer.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems, indicating compliance with performance requirements.
- 1.7 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.
- 1.8 QUALITY ASSURANCE
- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Manufacturer Qualifications: Manufacturer shall have produced the specified system or products for a period of one (1) year prior to beginning work of this section, and shall have the capability to produce the specified products to the delivery and quantity criteria of the project.
- C. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
- D. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.
- 1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.
- E. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.

1.9 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration caused by thermal movements.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - d. Water leakage through fixed glazing and framing areas.
 - e. Failure of operating components.
 - 2. Warranty Period: Five years from date of Substantial Completion.

1.11 MAINTENANCE SERVICE

- A. Entrance Door Hardware:
 - 1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.
 - 2. Initial Maintenance Service: Beginning at Substantial Completion, provide twelve months' full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Provide parts and supplies the same as those used in the manufacture and installation of original equipment.
 - 3. Continuing Maintenance Proposal: From Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Characteristics of specific products, where named in this Section, are indicated to establish required level of quality, appearance, and performance. Architect will consider requests for substitutions, under the provisions of Section 012500.
- B. Available Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Arcadia Inc.
 - 2. Kawneer North America; an Alcoa company.
 - 3. EFCO

2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1. Sheet and Plate: ASTM B 209.
 - 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - 3. Extruded Structural Pipe and Tubes: ASTM B 429.
 - 4. Structural Profiles: ASTM B 308/B 308M.
 - 5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.
- B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
 - 1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 - 2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 - 3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 STOREFRONT FRAMING SYSTEMS

- A. Types:
 - 1. SF-1: Arcadia, Inc., AFG451T Series, front glazed, sill cup and thermal break. Size: Nominal 2 inch x 4-1/2 inch profile.
 - 2.
- B. Performance:
 - 1. Base design load on 115 MPH wind speed, Exposure C, 30PSF and per Chap. 16, Part 2, Title 24, CCR.
 - 2. Importance Factor: 1.15.
 - 3. Deflection: Limited to 1/175 and allowable stress safety factor of 1.65.
 - 4. Air Infiltration: Assembly limited to 0.06 CFM per square foot at 1.56 PSF in accordance with ASTM E 283.
 - 5. Water Infiltration: No water penetration of assembly at 6.24 PSF in accordance with ASTM E 331.
 - 6. Thermal Movement: No damage to system or components resulting from expansion and contraction within system components caused by a cycling temperature range of 170 F degrees.
 - 7. Energy Performance: Glazed aluminum curtain walls shall have certified and labeled energy performance ratings in accordance with NFRC. Primary energy performance requirements usually include thermal transmittance (U-factor), solar heat gain coefficient, and air infiltration. Related and additional energy performance considerations include condensation resistance and visible light transmittance. Options in subparagraphs below are examples only. Revise values to suit climate zone of building envelope as defined by the 2003 IECC. Coordinate with Section 088000 "Glazing."
 - 8. Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to exterior.
- C. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 - 1. Glazing System: Retained mechanically with gaskets on four sides .
 - 2. Glazing Plane: Front.

- D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- E. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Cover Caps as indicated on drawings.
 - 2. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 3. Reinforce members as required to receive fastener threads. Self-tapping is not allowed. All attachments must be drill and tapped.
 - 4. Sill aprons and other aluminum finish pieces shall be brake formed or extruded, prefinished to match storefront, and attached with concealed fasteners.
 - 5. Provide continuous aluminum sill flashing at all storefront sill conditions. Extend sill flange up wall 2 inches at wall terminations.
 - 6. Provide all reinforcing and stiffeners, including concealed steel fabrications, required to comply with specified loading criteria and within profiles and design as shown on drawings.
- F. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- G. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.
- H. Finishes:
 - 1. Exposed Aluminum Surfaces:
 - a. Finish Type: Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

2.4 GLAZING SYSTEMS

- A. Glazing: As specified in Section 088000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.
- C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.
- D. Glazing Sealants: For structural-sealant-glazed systems, as recommended by manufacturer for joint type, and as follows:
 - 1. Structural Sealant: ASTM C 1184, single-component neutral-curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by a structural-sealant manufacturer for use in aluminum-framed systems indicated.
 - 2. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; single-component neutral-curing formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and aluminum-framed-system manufacturers for this use.
 - a. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Sealants used inside the weatherproofing system shall comply with the testing and product requirements of the California Department of Health Services' "Standard

Practice for the Testing of Volatile Organic Emissions from Various Sources
Using Small-Scale Environmental Chambers."

2.5 ACCESSORY MATERIALS

- A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Section 079200 "Joint Sealants."
- B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil (thickness per coat.

2.6 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
 - 4. Sill channel shall provide for exterior weepage through 1/2 inch x 5/16 elongated weep holes located at 6 inch on each side of vertical mullions.
 - 5. Framing members shall be internally reinforced and secured at head and sill as necessary for structural performance.
 - 6. Physical and thermal isolation of glazing from framing members.
 - 7. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 8. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- C. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- D. Entrance Door Frames: Reinforce as required and per the drawings to support loads imposed by door operation and for installing entrance door hardware.
 - 1. At exterior doors, provide compression weather stripping at fixed stops.
- E. Entrance Doors: Reinforce doors as required for installing entrance door hardware and as shown on drawings.
 - 1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
 - 2. At exterior doors, provide weather sweeps applied to door bottoms.
- F. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.7 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's written instructions.
 - 2. Do not install damaged components.
 - 3. Fit joints to produce hairline joints free of burrs and distortion.
 - 4. Rigidly secure nonmovement joints.
 - 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
 - 6. Seal joints watertight unless otherwise indicated.
- B. Metal Protection:
 - 1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
 - 2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
- D. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.
- E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.
- F. Install glazing as specified in Section 088000 "Glazing."
- G. Install perimeter joint sealants as specified in Section 079200 "Joint Sealants" to produce weathertight installation.

3.3 ERECTION TOLERANCES

- A. Install aluminum-framed systems to comply with the following maximum erection tolerances:
 - 1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/4 inch over total length.
 - 2. Alignment:
 - a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.
- B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

3.4 ADJUSTING

- A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.
 - 1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch, measured to the leading door edge.

END OF SECTION 084113

SECTION 08 71 00 – DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:

- 1. Mechanical door hardware for:

- a. Swinging doors.
 - b. Gates.

- B. Exclusions: Unless specifically listed in hardware sets, hardware is not specified in this section for:

- 1. Windows
 - 2. Cabinets (casework), including locks in cabinets
 - 3. Signage
 - 4. Toilet accessories
 - 5. Overhead doors
 - 6. Installation.
 - 7. Rough hardware.
 - 8. Conduit, junction boxes & wiring.
 - 9. Folding partitions, except cylinders where detailed.
 - 10. Sliding aluminum doors, except cylinders where detailed.
 - 11. Access doors and panels, except cylinders where detailed.

- C. Related Sections:

- 1. Division 01 Section “Alternates” for alternates affecting this section.
 - 2. Division 07 Section “Joint Sealants” for sealant requirements applicable to threshold installation specified in this section.
 - 3. Division 08 Sections for hollow metal doors and frames, wood doors, aluminum doors.
 - 4. Division 09 Sections for touchup finishing or refinishing of existing openings modified by this section.

1.3 REFERENCES

- A. UL - Underwriters Laboratories

- 1. UL 10B - Fire Test of Door Assemblies
 - 2. UL 10C - Positive Pressure Test of Fire Door Assemblies

3. UL 1784 - Air Leakage Tests of Door Assemblies
 4. UL 305 - Panic Hardware
- B. ANSI - American National Standards Institute
1. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
- C. California Code of Regulations
1. Title 24: California Building Standards Code

Use date of standard in effect as of Bid date.

BHMA – Builders Hardware Manufacturers Association
2019 California Building Code

Chapter 11B – Accessibility To Public Buildings, Public Accommodations,
Commercial Buildings and Public Housing

NFPA – National Fire Protection Association

NFPA 80 – Standard for Fire Doors and Other Opening Protectives.

NFPA 105 – Smoke and Draft Control Door Assemblies

NFPA 252 – Fire Tests of Door Assemblies

UL – Underwriters Laboratories

UL10C – Positive Pressure Fire Tests of Door Assemblies.

UL 305 – Panic Hardware

1.4 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 requirements.

B. Action Submittals:

1. Product Data: Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Samples for Verification: If requested by Architect, submit production sample or sample installations of each type of exposed hardware unit in finish indicated, and tagged with full description for coordination with schedule.
 - a. Samples will be returned to supplier in like-new condition. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.
3. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:

- a. Door Index; include door number, heading number, and Architects hardware set number.
- b. Opening Lock Function Spreadsheet: List locking device and function for each opening.
- c. Type, style, function, size, and finish of each hardware item.
- d. Name and manufacturer of each item.
- e. Fastenings and other pertinent information.
- f. Location of each hardware set cross-referenced to indications on Drawings.
- g. Explanation of all abbreviations, symbols, and codes contained in schedule.
- h. Mounting locations for hardware.
- i. Door and frame sizes and materials.

4. Key Schedule:

- a. Initiate and conduct meeting(s) with Owner representatives and hardware supplier to determine system keyway(s), keybow styles, structure, stamping, degree of physical security and degree of geographic exclusivity. Furnish Owner's written approval of the system; do not order keys or cylinders without written confirmation of actual requirements from the Owner.
- b. After Keying Conference, provide keying schedule listing levels of keying as well as explanation of key system's function, key symbols used and door numbers controlled.
- c. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
- d. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
- e. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
- f. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.
 - 1) Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.

5. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory prepared for door hardware installation.

C. Informational Submittals:

1. Qualification Data: For Supplier and Installer.
2. Warranty: Special warranty specified in this Section.

D. Closeout Submittals:

1. Operations and Maintenance Data : Provide in accordance with Division 01 and include:
 - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Name, address, and phone number of local representative for each manufacturer.
 - d. Final approved hardware schedule, edited to reflect conditions as-installed.
 - e. Final keying schedule

- f. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

1.5 QUALITY ASSURANCE

- A. Product Substitutions: Comply with product requirements stated in Division 01 and as specified herein.
 1. Where specific manufacturer's product is named and accompanied by "No Substitute," including make or model number or other designation, provide product specified. (Note: Certain products have been selected for their unique characteristics and particular project suitability.)
 - a. Where no additional products or manufacturers are listed in product category, requirements for "No Substitute" govern product selection.
 2. Where products indicate "acceptable manufacturers" or "acceptable manufacturers and products", provide product from specified manufacturers, subject to compliance with specified requirements and "Single Source Responsibility" requirements stated herein.
- B. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project.
 1. Scheduling Responsibility: Preparation of door hardware and keying schedules.
 2. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
 3. Coordination Responsibility: Coordinate installation of electronic security hardware with Architect and electrical engineers and provide installation and technical data to Architect and other related subcontractors.
- C. Installer Qualifications: Qualified tradesmen, skilled in application of commercial grade hardware with record of successful in-service performance for installing door hardware similar in quantity, type, and quality to that indicated for this Project.
- D. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.
- E. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
- F. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
 1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. at tested pressure differential of 0.3-inch wg of water.

G. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Inspect and discuss preparatory work performed by other trades.
3. Review required testing, inspecting, and certifying procedures.

H. Coordination Conferences:

1. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.
 - a. Attendees: Door hardware supplier, door hardware installer, Contractor.
 - b. After meeting, provide letter of compliance to Architect, indicating when meeting was held and who was in attendance.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

1. Deliver each article of hardware in manufacturer's original packaging.

C. Project Conditions:

1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
2. Provide secure lock-up for door hardware delivered to Project, but not yet installed. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

D. Protection and Damage:

1. Promptly replace products damaged during shipping.
2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

E. Deliver keys **and permanent cores** to Owner by registered mail or overnight package service.

1.7 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.

- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Direct shipments not permitted, unless approved by Contractor.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Years from date of Substantial Completion, for durations indicated.
 - a. Closers:
 - 1) Mechanical: 30 years.
 - b. Exit Devices:
 - 1) Mechanical: 3 years.
 - c. Locksets:
 - 1) Mechanical: 3 years.
 - 2) Electrified: 1 year.
 - d. Continuous Hinges: **10 years.**
 - e. Key Blanks: Lifetime
 - 2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

1.9 MAINTENANCE

- A. Extra Materials:
 - 1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- B. Maintenance Tools:
 - 1. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

1.10 REGULATORY REQUIREMENTS (code citations are CBC 2019)

- A. Doors/doorways as part of an accessible route shall comply with CBC Sections 11B-404.

- B. The clear opening width for a door shall be 32” minimum. For a swinging door it shall be measured between the face of the door and the stop, with the door open 90 degrees. There shall be no projections into it below 34” and 44” maximum projections into it between 34” and 80” above the finish floor or ground. Door closers and stops shall be permitted to be 78” minimum above the finish floor or ground. BCB Section 11B-404.2.3.
- C. Handles, pulls, latches, locks, and other operable parts on accessible doors shall comply with CBC Section 11B-309.4 and shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. Operable parts of such hardware shall be 34” minimum and 44” maximum above finish floor or ground. Where sliding doors are in the fully open position, operating hardware shall be exposed and usable from both sides. CBC section 11B-404.2.7.
- D. The force for pushing or pulling open a door shall be as follows: CBC Section 11B-404.2.9.
 - 1. Interior hinged doors, sliding or folding doors, and exterior hinged doors: 5 pounds (22.2 N) maximum. Required fire doors: the minimum opening force allowable by the DSA authority, not to exceed 15 pounds (66.7N). These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door in a closed position.
 - 2. The force required for activation any operable parts, such as lever hardware, or disengaging other devices shall be 5 pounds (22.2N) maximum to comply with CBC Section 11B-309.4.
- E. Door closing speed shall be as follows per CBC Section 11B-404.2.8:
 - 1. Closer shall be adjusted so that the required time to move a door from an open position of 90 degrees to a position of 12 degrees from the latch is 5 seconds minimum.
 - 2. Spring hinges shall be adjusted so that the required time to move a door from an open position of 70 degrees to the closed position is 1.5 seconds minimum.
- F. Thresholds shall comply with CBC Section 11B-404.2.5.
- G. Floor stops shall not be located in the path of travel and 4” maximum from walls.
- H. Hardware (including panic hardware) shall not be provided with “Night Latch” (NL) function for any accessible doors or gates unless the following conditions are met: (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).

PART 2 - products

2.1 MANUFACTURERS

- A. Where “No Substitute” is noted, submittals and substitution requests for other products will not be considered.

- B. Approval of manufacturers and/or products other than those listed as “Scheduled Manufacturer” or “Acceptable Manufacturer” in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.
- C. Approval of products from manufacturers indicated in “Acceptable Manufacturers” is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer’s product.
- D. Hand of Door: Drawings show direction of slide, swing, or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.
- E. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.2 MATERIALS

A. Fasteners

- 1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
- 2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
- 3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru-bolts are required.
- 4. Install hardware with fasteners provided by hardware manufacturer.
- B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.
 - 1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

2.3 HINGES

A. Manufacturers and Products:

- 1. Scheduled Manufacturer and Product: Ives 5BB series.
- 2. Acceptable Manufacturers and Products: Hager BB series, McKinney TA/T4A series, Stanley FBB Series

B. Requirements:

- 1. Provide five-knuckle ball bearing hinges conforming to ANSI/BHMA A156.1.
- 2. 1-3/4 inch thick doors, up to and including 36 inches wide:
 - a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches high
 - b. Interior: Standard weight, steel, 4-1/2 inches high

3. 1-3/4 inch thick doors over 36 inches wide:
 - a. Exterior: Heavy weight, bronze/stainless steel, 5 inches high
 - b. Interior: Heavy weight, steel, 5 inches high
4. Provide three hinges per door leaf for doors 90 inches or less in height, and one additional hinge for each 30 inches of additional door height.
5. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - a. Steel Hinges: Steel pins
 - b. Non-Ferrous Hinges: Stainless steel pins
 - c. Out-Swinging Exterior Doors: Non-removable pins
 - d. Out-Swinging Interior Lockable Doors: Non-removable pins
 - e. Interior Non-lockable Doors: Non-rising pins
6. Width of hinges: 4-1/2 inches at 1-3/4 inch thick doors, and 5 inches at 2 inches or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.
7. Doors 36 inches wide or less furnish hinges 4-1/2 inches high; doors greater than 36 inches wide furnish hinges 5 inches high, heavy weight or standard weight as specified.

2.4 CONTINUOUS HINGES

A. Aluminum Geared

1. Manufacturers:
 - a. Scheduled Manufacturer: Ives.
 - b. Acceptable Manufacturers: Markar, Stanley.
2. Requirements:
 - a. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
 - b. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum, with 0.25-inch diameter Teflon coated stainless steel hinge pin.
 - c. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
 - d. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
 - e. On fire-rated doors, provide aluminum geared continuous hinges that are classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
 - f. Install hinges with fasteners supplied by manufacturer.
 - g. Provide hinges 1 inch shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.5 MORTISE LOCKS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage L9000 series.
2. Acceptable Manufacturers and Products: No Substitute.

B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1 Operational, Grade 1 Security, and manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to “KEYING” article, herein.
2. Provide locks with standard 2-3/4 inches backset with full 3/4 inch throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1 inch throw, constructed of stainless steel.
3. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
4. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.
 - a. Lever Design: As scheduled.
 - b. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

2.6 AUXILIARY LOCKS

A. Deadlocks:

1. Manufacturers and Products:
 - a. Scheduled Manufacturer and Product: Schlage L400 series.
 - b. Acceptable Manufacturers and Products: No Substitute.
2. Requirements:
 - a. Provide mortise deadlock series conforming to ANSI/BHMA A156 and function as specified. Cylinders: Refer to “KEYING” article, herein.
 - b. Provide deadlocks with standard 2-3/4 inches backset. Provide deadbolt with full 1 inch throw, constructed of stainless steel.
 - c. Provide manufacturer’s standard strike.

2.7 EXIT DEVICES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Von Duprin 98 series.
2. Acceptable Manufacturers and Products: Sargent 19-43-GL-80 series, Precision Apex series.

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1, and UL listed for Panic Exit or Fire Exit Hardware. Cylinders: Refer to “KEYING” article, herein.

2. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
3. Touchpad: Extend minimum of one half of door width. Match exit device finish, stainless steel for US26, US26D, US28, US32, and US32D finishes; and for all other finishes, provide compatible finish to exit device. No plastic inserts are allowed in touchpads.
4. Provide exit devices with dead-latching feature for security and for future addition of alarm kits and/or other electrified requirements.
5. Provide flush end caps for exit devices.
6. Provide exit devices with manufacturer's approved strikes.
7. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
8. Mount mechanism case flush on face of doors, or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
9. Provide cylinder dogging at non-fire-rated exit devices.
10. Where lever handles are specified as outside trim for exit devices, provide heavy-duty lever trims with forged or cast escutcheon plates. Provide vandal-resistant levers that will travel to 90-degree down position when more than 35 pounds of torque are applied, and which can easily be re-set.
 - a. Lever Style: Match lever style of locksets.
 - b. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.
11. Accessibility: Maximum 5lbs force to retract latch bolt per CBC Chapter 11B.
 "AX" feature: touchpad directly retracts the latchbolt with 5 lb or less of force. Provide testing lab certification confirming that the mechanical device is independent third-party tested to meet this 5 lb requirement.
12. Provide UL labeled fire exit hardware for fire rated openings.
13. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.

2.8 ELECTRONIC ACCESS CONTROL LOCKSETS AND EXIT DEVICE TRIM

A. Manufacturers:

1. Scheduled Manufacturer and Product: Schlage CO series.
2. Acceptable Manufacturers and Products: No Substitute.

B. Product: Schlage **CO-200-MS/MD** standalone mortise-type electronic locksets.

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1 Operational, Grade 1 Security, and manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance. Provide lock case that is field reversible for handing without opening case.
2. Backset: 2-3/4-inch , nominal.
3. Latchbolt: 3-piece, beveled, stainless steel with 3/4-inch throw and anti-friction latch.

4. Deadbolt: Where deadbolt function is scheduled, provide stainless steel deadbolt interconnected with latch 1-5/8-inch (41 mm) high and 5/8-inch (16 mm) thick with 1-inch throw.
5. Chassis: ANSI/BHMA standard mortise lock prep for 1-3/4-inch (44 mm) doors.

C. Requirements:

1. Provide offline electronic access control products that comply with the following requirements:
 - a. Listed, UL 294 - The Standard of Safety for Access Control System Units.
 - b. Compliant with ANSI/BHMA A156.25 Grade 1 Operation and Security.
 - c. Certified to UL10C, FCC Part15, Florida Building Code Standards TAS 201 large missile impact, TAS 202 and TAS 203.
 - d. Compliant with ASTM E330 for door assemblies.
 - e. Compliant with ICC / ANSI A117.1, NFPA 101, NFPA 80, and Industry Canada RSS-210.
2. Functions: Provide functions as scheduled that are field configurable without taking the offline electronic product off the door.
3. Emergency Override: Provide mechanical key override; cylinders: Refer to “KEYING” article, herein.
4. Levers:
 - a. Vandal Resistance: Exterior (secure side) lever rotates freely while door remains locked, preventing damage to internal lock components from vandalism by excessive force.
 - b. Provide non-handed lever trim that operates independently of non-locking levers.
 - c. Style: **Rhodes (06)**
 - d. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.
5. Power Supply: 4 AA batteries
 - a. Provide electronic access control locks and/or exit device trim with the ability to communicate battery status.
6. Features:
 - a. Visual tri-colored LED indicators that indicate activation, operational systems status, system error conditions and low power conditions.
 - b. Visual bi-colored LED indicator on interior that is capable of indicating secured/unsecured status of device to occupants on interior.
 - c. Audible feedback that can be enabled or disabled.
 - d. Onboard processor with memory capacity of 2,000 users, 2,000 event audit history, up to 16 time zones and up to 32 calendar events.
 - e. Tamper-Resistant Screws: Tamper torx screws on inside escutcheon for increased security.
7. Switches:

- a. Mechanical Key Override
- b. Door Position Switch

8. Credential Reader:

- a. Credential Reader Configurations:
 - 1) Keypad.
- b. Credential Reader Capabilities: Provide credential readers capable of operating with the following integrated software partners.
 - 1) 12 button keypad with backlit buttons.

9. Operation:

- a. Provide electronic access control locks and/or exit device trim with the ability to be configured at door by handheld programming device the length of time device is unlocked upon access grant.
- b. Provide electronic access control locks and/or exit device trim with the ability to communicate identifying information such as firmware versions, hardware versions, serial numbers, and manufacturing dates by handheld programming device.

D. Components

- 1. Product: Schlage HHD series with Utility Software.
 - a. Provide Handheld Programming Device for adaptable electronic access control products capable of the following minimum requirements.
 - 1) Capable of initializing lock and accessories using preloaded software.
 - 2) Utilized to field configure electronic access control devices, to download firmware updates and door files to device, and to download audit files from device.

2.9 CYLINDERS

A. Manufacturers:

- 1. Scheduled Manufacturer: ASSA.
- 2. Acceptable Manufacturers: No Substitute.

B. Requirements:

- 1. Provide cylinders/cores to match Owner's existing key system, compliant with ANSI/BHMA A156.5; latest revision, Section 12, Grade 1; permanent cylinders; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.
- 2. Temporary Construction Cylinder Keying.
 - a. Provide construction cores that permit voiding construction keys without cylinder removal, furnished in accordance with the following requirements.
 - 1) Split Key or Lost Ball Construction Keying System.
 - 2) 3 construction control keys, and extractor tools or keys as required to void construction keying.

- 3) 12 construction change (day) keys.
- b. Owner or Owner's Representative will void operation of temporary construction keys.

2.10 KEYING

- A. Provide cylinders/cores keyed into Owner's existing factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.
- B. Requirements:
 1. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
 - a. Master Keying system as directed by the Owner.
 2. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements shall be cause for replacement of cylinders/cores involved at no additional cost to Owner.
 3. Provide keys with the following features:
 - a. Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
 4. Identification:
 - a. Mark permanent cylinders/cores and keys with applicable blind code per DHI publication "Keying Systems and Nomenclature" for identification. Blind code marks shall not include actual key cuts.
 - b. Identification stamping provisions must be approved by the Architect and Owner.
 - c. Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
 - d. Failure to comply with stamping requirements shall be cause for replacement of keys involved at no additional cost to Owner.
 - e. Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.
 5. Quantity: Furnish in the following quantities.
 - a. Change (Day) Keys: 3 per cylinder/core.
 - b. Master Keys: 6.

2.11 KEY CONTROL SYSTEM

- A. Manufacturers:
 1. Scheduled Manufacturer: Telkee.
 2. Acceptable Manufacturers: HPC, Lund.

B. Requirements:

1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.
 - a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.
 - b. Provide hinged-panel type cabinet for wall mounting.

2.12 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: LCN 4040XP series.
2. Acceptable Manufacturers and Products: 281 series factory assembled (without PRV), Norton 9500 series.

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2 inch diameter with 3/4 inch diameter double heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.13 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Rockwood, Trimco.

B. Requirements:

1. Provide push plates 4 inches wide by 16 inches high by 0.050 inch thick and beveled 4 edges. Where width of door stile prevents use of 4 inches wide plate, adjust width to fit.
2. Provide push bars of solid bar stock, diameter and length as scheduled. Provide push bars of sufficient length to span from center to center of each stile. Where required, mount back to back with pull.
3. Provide offset pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
4. Provide flush pulls as scheduled. Where required, provide back-to-back mounted model.
5. Provide pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
6. Provide pull plates 4 inches wide by 16 inches high by 0.050 inch thick, beveled 4 edges, and prepped for pull. Where width of door stile prevents use of 4 inches wide plate, adjust width to fit.
7. Provide wire pulls of solid bar stock, diameter and length as scheduled.

2.14 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Rockwood, Trimco.

B. Requirements:

1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes of plates:
 - a. Kick Plates: 10 inches high by 2 inches less width of door on single doors, 1 inch less width of door on pairs
 - b. Mop Plates: 6 inches high by 2 inches less width of door on single doors, 1 inch less width of door on pairs

2.15 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers: Glynn-Johnson.
2. Acceptable Manufacturers: Rixson, Sargent.

B. Requirements:

1. Provide heavy duty concealed mounted overhead stop or holder as specified for exterior and interior vestibule single acting doors.
2. Provide heavy duty concealed mounted overhead stop or holder as specified for double acting doors.
3. Provide heavy or medium duty and concealed or surface mounted overhead stop or holder for interior doors as specified. Provide medium duty surface mounted overhead

- stop for interior doors and at any door that swings more than 140 degrees before striking wall, open against equipment, casework, sidelights, and where conditions do not allow wall stop or floor stop presents tripping hazard.
4. Where overhead holders are specified provide friction type at doors without closer and positive type at doors with closer.

2.16 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Rockwood, Trimco.

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
2. Where a wall stop cannot be used, provide universal floor stops for low or high rise options.
3. Where wall or floor stop cannot be used, provide medium duty surface mounted overhead stop.

2.17 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer: Zero International.
2. Acceptable Manufacturers: National Guard, Pemko.

B. Requirements:

1. Provide thresholds, weather-stripping (including door sweeps, seals, and astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
2. Size of thresholds:
 - a. Saddle Thresholds: 1/2 inch high by jamb width by door width
 - b. Bumper Seal Thresholds: 1/2 inch high by 5 inches wide by door width
3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

2.18 FINISHES

A. Finish: BHMA 626/652 (US26D); except:

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Continuous Hinges: BHMA 628 (US28)
3. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
4. Protection Plates: BHMA 630 (US32D)

5. Overhead Stops and Holders: BHMA 630 (US32D)
6. Door Closers: Powder Coat to Match
7. Wall Stops: BHMA 630 (US32D)
8. Weatherstripping: Clear Anodized Aluminum
9. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Where on-site modification of doors and frames is required:
 1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
 2. Field modify and prepare existing door and frame for new hardware being installed.
 3. When modifications are exposed to view, use concealed fasteners, when possible.
 4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:
 - a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
 - b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
 - c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 2. Custom Steel Doors and Frames: HMMA 831.
 3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

- D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- H. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Replace construction cores with permanent cores as indicated in keying section.
- I. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- J. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Closers shall not be visible in corridors, lobbies and other public spaces unless approved by Architect.
- K. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- L. Stops: Provide wall stops for doors unless floor or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.
- M. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- N. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.5 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.

- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DEMONSTRATION

- A. Provide training for Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

3.7 DOOR HARDWARE SCHEDULE

- A. Locksets, exit devices, and other hardware items are referenced in the following hardware sets for series, type and function. Refer to the above-specifications for special features, options, cylinders/keying, and other requirements.
- B. Do not order material until submittal has been reviewed, stamped, and signed by Architect's door hardware consultant.
- C. Hardware Sets:

OVERTUR: OPT0305097 (VER. 2)

HW SET: 1.0

DOOR NUMBERS:

106 206

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	PA-AX-98-NL-OP-110MD	630	VON
1	EA	RIM CYLINDER	8851	626	ASA
1	EA	VANDAL RESISTANT TRIM	VR910 NL	630	IVE
1	EA	CONC OVERHEAD STOP	100S	630	GLY
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	SET	GASKETING	8303AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER SILL DETAIL	A	ZER

HW SET: 2.0

DOOR NUMBERS:

107 110-A 114 204

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	L9081L 06L	630	SCH
1	EA	MORTISE CYLINDER	8852 #6 CAM	626	ASA
1	EA	CONC OVERHEAD STOP	100S (AS REQ'D IN LIEU OF WALL/FLOOR STOP)	630	GLY
1	EA	SURFACE CLOSER	4040XP REG / 4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	DOOR STOP - WALL/FLOOR	WS406/407CVX / FS18S (AS REQ'D)	BLK	IVE
1	SET	GASKETING	8303AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER SILL DETAIL	A	ZER

NOTE: MOUNT DOOR CLOSER ON "PUSH SIDE" OF OUTSWINGING DOORS.

HW SET: 2.5

DOOR NUMBERS:

104

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	630	IVE
1	EA	STOREROOM LOCK	L9081L 06L	630	SCH
1	EA	MORTISE CYLINDER	8852 #6 CAM	626	ASA
1	EA	SURFACE CLOSER	4040XPT (PULL SIDE MOUNT)	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	SET	GASKETING	8303AA-S	AA	ZER
1	EA	AUTO DOOR BOTTOM	355AA	AA	ZER
1	EA	THRESHOLD	PER SILL DETAIL	A	ZER

HW SET: 3.0

DOOR NUMBERS:

115

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	ACCESSIBLE STOREROOM LOCK	L9081L 06L	630	SCH
1	EA	MORTISE CYLINDER	8852 #6 CAM	626	ASA
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

Murrieta Elementary School New CR Bldg

087100 DOOR HARDWARE

Murrieta Valley Unified School District

087100 - 20

BakerNowicki Design Studio #18009-00

HW SET: 4.0

DOOR NUMBERS:

100	101	102	103	110	111
112	200	201	202	203	210
211	212				

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224HD	628	IVE
1	EA	CLASSROOM SECURITY	L9071L 06N L283-711	630	SCH
2	EA	MORTISE CYLINDER	8852 #6 CAM	626	ASA
1	EA	SURFACE CLOSER	4040XP HEDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS18S	BLK	IVE
1	SET	GASKETING	8303AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER SILL DETAIL	A	ZER

HW SET: 5.0

DOOR NUMBERS:

109	209
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EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	630	IVE
1	EA	ELEC PRIVACY LOCK	CO-200-MD-40-KP-RHO-L 4B	626	SCE
		BATTERY OPERATED			
1	EA	MORTISE CYLINDER	8852 #6 CAM	626	ASA
1	EA	SURFACE CLOSER	4040XP REG	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	MOP PLATE	8400 6" X 1" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	SET	GASKETING	8303AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER SILL DETAIL	A	ZER
1	EA	HANDHELD DEVICE	HHD-KIT-USB		SCE

HW SET: 6.0

DOOR NUMBERS:

105 108 205 208

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	CLASSROOM DEAD LOCK	L463L XB11-720	626	SCH
1	EA	MORTISE CYLINDER	8852 #6 CAM	626	ASA
1	EA	PUSH PLATE	8200 4" X 16" CFT	630	IVE
1	EA	PULL PLATE	8302 6" 4" X 16" CFC	630	IVE
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	SET	GASKETING	8303AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER SILL DETAIL	A	ZER

HW SET: 7.0

DOOR NUMBERS:

207

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	L9081L 06L	630	SCH
1	EA	MORTISE CYLINDER	8852 #6 CAM	626	ASA
1	EA	SURFACE CLOSER	4040XP REG	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	THRESHOLD	PER SILL DETAIL	A	ZER

HW SET: 8.0

DOOR NUMBERS:

110-A1 110-B 110-C 110-D

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	OFFICE/ENTRY LOCK	L9050L 06L L583-363	626	SCH
1	EA	MORTISE CYLINDER	8852 #6 CAM	626	ASA
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HW SET: 9.0

DOOR NUMBERS:

100A 101A 112A 200A 201A 202A
 211A 212A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	DBL CYL STORE W/DB	L9466L 06N XL13-228	626	SCH
2	EA	MORTISE CYLINDER	8852 #6 CAM	626	ASA
1	EA	SURFACE CLOSER	4040XP HEDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	AUTO DOOR BOTTOM	320AA	AA	ZER
1	EA	THRESHOLD	PER SILL DETAIL	A	ZER

HW SET: 10

DOOR NUMBERS:

G103 G104 G110

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	GATE HINGE	BY GATE MANUFACTURER		B/O
1	EA	CANE BOLT	BY GATE MANUFACTURER		B/O
1	EA	FORK GATE LATCH	BY GATE MANUFACTURER		B/O
1	EA	WELDED KICK PLATE	BY GATE MANUFACTURER		B/O

ALL HARDWARE TO BE SUPPLIED BY THE STEEL GATE MANUFACTURER.

HW SET: 11

DOOR NUMBERS:

G105

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	GATE HINGE	BY GATE MANUFACTURER		B/O
2	EA	CANE BOLT	BY GATE MANUFACTURER		B/O

ALL HARDWARE TO BE SUPPLIED BY THE STEEL GATE MANUFACTURER.

HW SET: 12

DOOR NUMBERS:

G106

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	GATE HINGE	BY GATE MANUFACTURER		B/O
2	EA	PANIC HARDWARE	PA-AX-98-NL-OP-110MD-WH	628	VON
2	EA	RIM CYLINDER	8851	626	ASA
2	EA	VANDAL RESISTANT TRIM	VR910 NL	630	IVE
2	EA	SURFACE CLOSER	4040XPT SRI ST-3592	689	LCN
2	EA	WELDED KICK PLATE	BY GATE MANUFACTURER		B/O
2	EA	WELDED PANIC HARDWARE PLATE	BY GATE MANUFACTURER		B/O

ALL OTHER HARDWARE TO BE SUPPLIED BY THE STEEL GATE MANUFACTURER.

HW SET: 13

DOOR NUMBERS:

G102

G107

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	GATE HINGE	BY GATE MANUFACTURER		B/O
1	EA	PANIC HARDWARE	PA-AX-98-NL-OP-110MD-WH	628	VON
1	EA	RIM CYLINDER	8851	626	ASA
1	EA	VANDAL RESISTANT TRIM	VR910 NL	630	IVE
1	EA	SURFACE CLOSER	4040XPT SRI ST-3592	689	LCN
1	EA	WELDED KICK PLATE	BY GATE MANUFACTURER		B/O
1	EA	WELDED PANIC HARDWARE PLATE	BY GATE MANUFACTURER		B/O

ALL OTHER HARDWARE TO BE SUPPLIED BY THE STEEL GATE MANUFACTURER.

HW SET: 14

DOOR NUMBERS:

G101 G108 G109

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	GATE HINGE	BY GATE MANUFACTURER		B/O
1	EA	CANE BOLT	BY GATE MANUFACTURER		B/O
1	EA	FORK GATE LATCH	BY GATE MANUFACTURER		B/O

ALL HARDWARE TO BE SUPPLIED BY THE STEEL GATE MANUFACTURER.

11

HW SET: 15

DOOR NUMBERS:

G111

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	GATE CLOSER AND HINGE	MAMMOTH-180	AL	LOX
2	SET	CHAIN LINK BRACKET	CLB-MAMMOTH	AL	LOX
1	EA	CANE BOLT	BY GATE MANUFACTURER		B/O
1	EA	PANIC HARDWARE	PA-AX-98-NL-OP-110MD-WH	628	VON
1	EA	RIM CYLINDER	8851	626	ASA
1	EA	VANDAL RESISTANT TRIM	VR910 NL	630	IVE
1	EA	KICK PLATE	BY GATE MANUFACTURER		B/O
1	EA	PANIC HARDWARE MOUNTING PLATE	BY GATE MANUFACTURER		B/O

ALL OTHER HARDWARE TO BE SUPPLIED BY THE GATE MANUFACTURER.

HW SET: 16

DOOR NUMBERS:

G112E

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
	EA	GATE HINGE	EXISTING TO REMAIN		B/O
1	EA	CANE BOLT	524P23 3/4" X 24"	630	CRO
1	EA	CANE BOLT PAD LOCKABLE ASSEMBLY	0524PL-S (LESS PADLOCK)	630	CRO
1	EA	PANIC HARDWARE	PA-AX-98-NL-OP-110MD-WH	628	VON
1	EA	RIM CYLINDER	8851	626	ASA
1	EA	VANDAL RESISTANT TRIM	VR910 NL	630	IVE
1	EA	WALL MOUNTED SURFACE CLOSER	4000T MC SRI ST-2967 WMS	MTLPC	LCN

REMOVE EXISTING SLIDE BOLT AND CANE BOLT.

INSTALL PANIC HARDWARE, VANDAL RESISTANT TRIM AND CLOSER ON ACTIVE LEAF.

INSTALL CANE BOLT ON INACTIVE LEAF.

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END OF SECTION

SECTION 088000 - GLAZING

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 glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Windows.
 - 2. Doors.
 - 3. Storefront framing.
 - 4. Glazed entrances.
 - 5. Interior borrowed lites.

1.3 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. Interspace: Space between lites of an insulating-glass unit.

1.4 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. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

1.5 ACTION SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Glass Samples: For each type of glass product; 12 inches square.
- C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installers.
- B. Product Certificates: For glass and glazing products, from manufacturer.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for insulating glass.

1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

D. Warranties: Sample of 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 and certified 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.
- D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
- E. Source Limitations for Glass: Obtain insulating glass from single source from single manufacturer for each glass type.
- F. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.
- G. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 1. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
 - 2.
 3. IGMMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- H. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- I. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F, and the fire-resistance rating in minutes.
- J. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- K. Safety Standards: Comply with CBC Chapter 24, safety glazing requirements.

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 recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F.

1.10 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 Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- C. 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 GLASS PRODUCTS, GENERAL

- A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
- B. 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. For monolithic-glass lites, properties are based on units with lites of thickness indicated.
2. For laminated-glass lites, properties are based on products of construction indicated.
3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. 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.
5. 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.
6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 INSULATING GLASS (GL-1)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:
- B. Vitro Architectural Glass, <http://www.vitroglazings.co>Fabricator: Fabricator: Oldcastle Glass, www.OldcastleGlass.com. (702) 456-6665, or HGP Industries, or equal.
- C. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.
- D. Type:
 1. Dual glazed glass units, fully tempered, 1/4-inch PPG Solarban 70XL(2) with 1/4-inch Clear, single vision, tempered, clear float glass inside.
- E. Characteristics:
 1. Total thickness: One inch, and as required by code, with 1/2 inch air space.
 2. Strength: Each lite fully Tempered (Kind FT) per ASTM C 1048 and ASTM C 1036. Permanently label all tempered glass.
 3. Visible Light Transmission: 64%.
 4. U-value - Summer Daytime: 0.26.
 5. U-value - Winter Night: 0.28.
 6. Solar Heat Gain Coefficient: 0.27.
 7. Shading Coefficient: 0.32.
 8. Outdoor Visible Light Reflectance: 12%.

2.3 MONOLITHIC GLASS

- A. FULLY TEMPERED, CLEAR (GL-4)
 1. Glass Manufacturer: Vitro Architectural Glass, <http://www.vitroglazings.co>or equal.
 2. Series/Type: Single glazed glass units, fully tempered clear float glass, PPG, clear.
 3. Total thickness: 1/4 inch.

2.4 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).
- F. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.5 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.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

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 will 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. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge

damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

3.4 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 088000

SECTION 092116.23 - GYPSUM BOARD SHAFT WALL ASSEMBLIES

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: Gypsum board shaft wall assemblies.

1.3 ACTION SUBMITTALS

- A. Product Data: For each component of gypsum board shaft wall assembly.

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For shaft wall assemblies firestop tracks, from ICC-ES.

1.5 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.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or with gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install interior products until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, or mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy 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: Provide materials and construction identical to those of assemblies tested according to ASTM E 90 and classified according to ASTM E 413 by a testing and inspecting agency.
- C. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 GYPSUM BOARD SHAFT WALL ASSEMBLIES

- A. Fire-Resistance Rating: As indicated.

- B. STC Rating: As indicates.
 - C. Gypsum Shaftliner Board:
 - 1. Type X: ASTM C 1396/C 1396M; manufacturer's proprietary fire-resistive liner panels with paper faces, 1-inch thick, with double beveled long edges.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) National Gypsum Company.
 - 2) PABCO Gypsum.
 - 3) United States Gypsum Company.
 - 4) Or Equal.
 - D. Non-Load-Bearing Steel Framing, General: Complying with ASTM C 645 requirements for metal unless otherwise indicated and complying with requirements for fire-resistance-rated assembly indicated.
 - 1. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.
 - E. Studs: Manufacturer's standard profile for repetitive, corner, and end members as follows:
 - 1. Depth: As indicated.
 - 2. Minimum Base-Metal Thickness: 0.033 inch.
 - F. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least 2 inches long and matching studs in depth.
 - 1. Minimum Base-Metal Thickness: 0.033 inch.
 - G. 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. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Blazeframe Industries.
 - b. California Expanded Metal Company (CEMCO).
 - c. ClarkDietrich Building Systems.
 - d. Or Equal.
 - H. Elevator Hoistway Entrance Struts: Manufacturer's standard J-profile jamb strut with long-leg length of 3 inches, matching studs in depth, and not less than 0.033 inch thick.
 - I. Room-Side Finish: Gypsum board.
 - J. Shaft-Side Finish: As indicated by fire-resistance-rated assembly design designation.
 - K. Gypsum Board: As specified in Section 092900 "Gypsum Board."
 - L. Insulation: Sound attenuation blankets.
- 2.3 AUXILIARY MATERIALS
- A. General: Provide auxiliary materials that comply with manufacturer's written recommendations.
 - B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes as specified in Section 09 29 00 "Gypsum Board" that comply with gypsum board shaft wall assembly manufacturer's written recommendations for application indicated.

- C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
- D. Track Fasteners: Powder-driven fasteners of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.
 - 1. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488/E 488M conducted by a qualified testing agency.
 - 2. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.
- E. Sound Attenuation Blankets: As specified in Section 092900 "Gypsum Board."
- F. Acoustical Sealant: As specified in Section 079200 "Joint Sealants."
- G. Reinforcing: Galvanized-steel reinforcing strips with 0.033-inch minimum thickness of base metal (uncoated).
- H. Gypsum Board Cants:
 - 1. Gypsum Board Panels: As specified in Section 092900 "Gypsum Board," Type X, 5/8-inch panels.
 - 2. Adhesive: Laminating adhesive as specified in Section 092900 "Gypsum Board."
 - 3. Non-Load-Bearing Steel Framing: As specified in Section 092216 "Non-Structural Metal Framing."

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. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install gypsum board shaft wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and ASTM C 754 other than stud-spacing requirements.
- B. Do not bridge building expansion joints with shaft wall assemblies; frame both sides of expansion joints with furring and other support.
- C. Install supplementary framing in gypsum board shaft wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, wall-mounted door stops, and similar items that cannot be supported directly by shaft wall assembly framing.
 - 1. Elevator Hoistway: At elevator hoistway-entrance door frames, provide jamb struts on each side of door frame.

- 2. Reinforcing: Provide where items attach directly to shaft wall assembly as indicated on Drawings; accurately position and secure behind at least one layer of face panel.
 - D. Penetrations: At penetrations in shaft wall, maintain fire-resistance rating of shaft wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.
 - E. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels, while maintaining continuity of fire-rated construction.
 - F. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 - G. Control Joints: Install control joints at locations indicated on Drawings and according to ASTM C 840 and in specific locations approved by Architect while maintaining fire-resistance rating of gypsum board shaft wall assemblies.
 - H. Sound-Rated Shaft Wall Assemblies: Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly.
 - I. Gypsum Board Cants: At projections into shaft exceeding 4 inches, install 1/2- or 5/8-inch-thick gypsum board cants covering tops of projections.
 - 1. Slope cant panels at least 75 degrees from horizontal. Set base edge of panels in adhesive and secure top edges to shaft walls at 24 inches o.c. with screws fastened to shaft wall framing.
 - 2. Where steel framing is required to support gypsum board cants, install framing at 24 inches o.c. and extend studs from the projection to shaft wall framing.
 - J. 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.
- 3.3 PROTECTION
- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
 - B. Remove and replace panels that are wet, moisture damaged, or mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and 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 092116.23

SECTION 092216 - NON-STRUCTURAL 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. Section Includes:
 - 1. Non-load-bearing steel framing systems for interior partitions.
 - 2. Suspension systems for interior ceilings and soffits.
 - 3. Grid suspension systems for gypsum board ceilings.
- B. Related Requirements:
 - 1. Section 054000 "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.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of code-compliance certification for studs and tracks.
- B. Evaluation Reports: For embossed steel studs and tracks firestop tracks post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

- A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the CSSA, SFIA, or SSFM.

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.
- C. Suspended gypsum board ceiling systems shall comply with DSA IR-25-3.13.

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: ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.
- B. Studs and Tracks: ASTM C 645. Use either steel studs and tracks or embossed steel studs and tracks.
1. Steel Studs and Tracks:
 - 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) CEMCO; California Expanded Metal Products Co.
 - 2) MRI Steel Framing, LLC.
 - 3) Phillips Manufacturing Co.
 - 4) USG
 - 5) Or Equal.
 - b. Minimum Base-Metal Thickness: As indicated on Drawings.
 - c. Depth: As indicated on Drawings.
 2. Embossed Steel Studs and Tracks:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) CEMCO; California Expanded Metal Products Co.
 - 2) ClarkDietrich Building Systems.
 - 3) Phillips Manufacturing Co.
 - 4) Or Equal.
 - b. Minimum Base-Metal Thickness: As indicated on Drawings.
 - c. Depth as indicated on Drawings.
- C. Slip-Type Head Joints: Where indicated, provide one of the following:
1. Single Long-Leg Track System: ASTM C 645 top track with 2-inch-deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top track and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
 2. Double-Track System: ASTM C 645 top outer tracks, inside track with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction fit over inner track.
 3. Deflection Track: Steel sheet top track 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) CEMCO; California Expanded Metal Products Co.
 - 2) ClarkDietrich Building Systems.
 - 3) MBA Building Supplies.
 - 4) Or Equal.
- D. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. BlazeFrame Industries.
 - b. CEMCO; California Expanded Metal Products Co.
 - c. Fire Trak Corp.
 - d. Or Equal.
- 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, 0.0538-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: Hat shaped.
- I. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges.
 - 1. Depth: As indicated on Drawings.
 - 2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 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 0.0179 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, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.
- B. Hanger Attachments to Concrete:
 - 1. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488/E 488M conducted by a qualified testing agency.
 - 2. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- D. Flat Hangers: Steel sheet, in size indicated on Drawings.
- E. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch-wide flanges.
 - 1. Depth: As indicated on Drawings.

- F. Furring Channels (Furring Members):
 - 1. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
 - a. Minimum Base-Metal Thickness: As indicated on Drawings.
- G. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong World Industries, Inc.
 - b. Chicago Metallic Corporation.
 - c. United States Gypsum Company.
 - d. Or Equal.

2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 - 1. Fasteners for Steel 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/D 226M, 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.
 - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
- B. Coordination with Sprayed Fire-Resistive Materials:

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
 - 1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.
 - 2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
 - 3. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. 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 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 that penetrate 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 track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. 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.
 - c. 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-Shaped Furring Members:
 - 1. Erect insulation, specified in Section 07 21 00 "Thermal Insulation," vertically and hold in place with Z-shaped 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 CEILING 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 by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - 5. Do not attach hangers to steel roof deck.
 - 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 - 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 - 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- F. 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.

- G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

SECTION 092400 - PORTLAND CEMENT PLASTERING

PART 1 - GENERAL

1.1 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. Exterior portland cement plasterwork on metal lath.
 - 2. Exterior horizontal and nonvertical plasterwork.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- 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 Initial Selection: For each type of factory-prepared finish coat indicated.

1.4 QUALITY ASSURANCE

- A. Mockups: Before plastering, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Install mockups for each type of finish indicated.
 - 2. For interior plasterwork, simulate finished lighting conditions for review of mockups.
- B. Preinstallation Conference: Conduct conference at Project site.

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. Self Furred Metal Lath: Cemco or equal, Cem-Lath, 3.4 lb/sq. yd, G40 galvanized finish, self-furring or Structa Mega Lath, Structa Wire Corp.
 - 1. Combination lath and underlayment may be used with Architects prior approval.

- B. Lath at plaster soffit: Cemco, Cem-Lath D, 3.4 lb/sq yd, expanded metal lath, non-furring style at spaced framing, G40 galvanized finish, with Grade D paper backing.

2.2 UNDERLAYMENT

- A. Paper Backing: Fortiber or equal, Super Jumbo Tex, exceeding FS-UU-B-790, type I, Grade D as specified:
- B. Water vapor transmission: minimum 11 perms per ASTM E 96, method A
 - 1. Water Resistance: Minimum 60 minutes per ASTM D 779.
 - 2. Tensile Strength: Minimum 70 lb/inch MD/60 lb/inch CD.

2.3 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 or equal:
 - a. Stockton.
 - b. Fry Reglet Corporation.
 - c. Cemco.
 - 2. Accessories:
 - a. Weep Screed: Stockton, J-B, 7/8 inch wide by 5 inch tall, with weep holes, aluminum.
 - b. Cornerite: Fabricated from metal lath with ASTM A 653/A 653M, G60, hot-dip galvanized zinc coating.
 - c. External-Corner Reinforcement: Fabricated from metal lath with ASTM A 653/A 653M, G60, hot-dip galvanized zinc coating.
 - d. Cornerbeads: Stockton, PCM,
 - e. J Molding: Stockton, SFC, 7/8 inch wide by 1 1/4 inch tall, galvanized, primed and painted.
 - f. Control Joints: Cemco XJ-15, aluminum; 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.
 - g. Fascia Soffit Mold: Stockton FSM, 1 inch reveal, non vented, aluminum.
 - h. Expansion Joint: Stockton EWC, 1 inch reveal, aluminum.
 - i. Soffit Vent: Stockton STM, 2 1/2 inch vent, aluminum.
 - 3. Corner Reinforcing Lath: 2.7 lb/sq yd expanded metal lath, G40 galvanized, or approved equivalent at all openings.
 - 4. Elastomeric Flashing: Elastomeric sheet waterproofing per 071353.

2.4 MISCELLANEOUS MATERIALS

- A. Water for Mixing: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.
- B. 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.
- C. Fasteners for Attaching Metal Lath to Substrates: Complying with ASTM C 1063.

- D. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch diameter, unless otherwise indicated.

2.5 PLASTER MATERIALS RAPID SET

- A. RapidSet Cement: Rapid Set®EISENWALL®Cement; www.ctscement.com, rapidsetting, high early-strength, low shrinkage plastic cement, and with following mix performance.
 - 1. Compressive Strength per ASTM C 109: 400 psi at 6 hours; 1500 psi at 24 hours; 2900 psi at 72 hours; 3500 psi at 28 days.
 - 2. Set tile per ASTM C 401: Initial set at minimum 90 minutes and maximum at 150 minutes.
 - 3. Drying Shrinkage per ASTM C 596 modified: 0.019 percent maximum at 28 days.
 - 4. Use of admixtures of any kind are prohibited.
 - 5. Comply with ICC ESR 2671.
 - 6. Lime: ANSI/ASTM C206, Type S.
- B. Aggregate: Clean sharp plastering sand, complying with ASTM C144 and ASTM C897, and complying with the: following percent retained by weight, plus or minus 2 percent gradation.
 - 1. No. 4: 0 to 0
 - 2. No 8: 0 to 10
 - 3. No 16: 10 to 40
 - 4. No 30: 40 to 65
 - 5. No. 50: 70 to 90
 - 6. No ...100: 95 to 100
- C. Water: Clean, fresh, potable and free of mineral or organic matter which can affect plaster.
- D. Glass Fiber Reinforcing: Fibermesh Harbourite, AR type, complying with ASTM C 1116, with glass fiber, length, proportion and density per manufacturer's recommendations.
- E. Admixture: Larsen Acrylic Ad-Mix 101 or equal, bonding agent admixture at masonry/concrete plaster mix applications.
- F. Plaster Bonding Agent: Larsen Weld-Crete or equal, surface application bonding agent.

2.6 FIELD MIX PLASTER MATERIAL NON RAPID SET

- A. Cement: ASTM C150, Type II Portland Cement, low alkali.
 - 1. Use of plastic cement is not permitted.
- B. Lime: ANSI/ASTM C206, Type S.
- C. Aggregate: Clean sharp plastering sand, complying with ASTM C144 and ASTM C897.
- D. Water: Clean, fresh, potable and free of mineral or organic matter which can affect plaster.
- E. Glass Fiber Reinforcing: Fibermesh Harbourite, AR type, complying with ASTM C 1116, with glass fiber, length, proportion and density per manufacturer's recommendations.
- F. Admixture: Larsen Acrylic Ad-Mix 101 or equal, bonding agent admixture at masonry/concrete plaster mix applications.
- G. Plaster Bonding Agent: Larsen Weld-Crete or equal, surface application bonding agent.

2.7 CEMENT PLASTER MIXES RAPID SET

- A. Mix and proportion RapidSet cement plaster in accordance with ICC ESR 2671. Do not add plasticizers of any kind. Incorporate specified fiber reinforcing in mix design.
- B. Mix only as much plaster as can be used in accordance with manufacturers procedures.
- C. Protect mixtures from frost, contamination, and evaporation.
- D. Do not retemper mixes after initial set has occurred.

2.8 METAL SUSPENSION SYSTEM

- A. Type: Runner and furring channel grid system.
- B. Components
 - 1. Main Runner: Provide hot rolled channels, size as shown on drawings, minimum 1-1/2 inch deep, minimum 1.12 pounds per linear foot minimum, hot dip galvanized.
 - 2. Cross-Furring: Provide hot rolled channels, size as shown on drawings, minimum 1 inch deep, minimum 0.410 pounds per linear foot, hot dip galvanized.
 - 3. Vertical Hanger Wire: Prestretched steel wire, Number 8, galvanized.
 - 4. Saddle Tie Wire: Prestretched steel wire, Number 16, galvanized.

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. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.
- B. Prepare solid substrates for plaster that are smooth or that do not have the suction capability required to bond with plaster according to ASTM C 926.
- C. Installing Underlayment at framed walls:
 - 1. Unless specified otherwise, install Grade D underlayment.
 - 2. Install first course of underlayment shingle fashion, perpendicular to studs, attaching to studs with approved fasteners. Lap edges and ends 6 inches. Do not tear. Seal vertical edges with tape.
 - 3. Install second course of underlayment per 2, shingle fashion, with joints offset 6 inches from first course.
 - 4. Install two layers of waterproof underlayment over top of framed walls. Do not fasten through top of wall. Shingle lap over wall underlayment.
 - 5. Weather lap underlayment and elastomeric flashing with sheet metal flashing conditions.
 - 6. Install self adhesive elastomeric flashing as sill, head and jamb flashing at openings and at sloped plaster surfaces in compliance with manufacturers recommendations, weather lapping each course. Lap elastomeric flashing at opening; lap over head and jamb flashing and under sill flashing.

7. Do not anchor through horizontal or sloped surface. Extend up vertical surfaces of opening and beneath sills a minimum of 6 inches.
8. Coordinate underlayment placement with installation of elastomeric flashing conditions.
9. Install approved sealant over tears, holes and all fasteners not located at framing members.

- D. Coordinate underlayment placement with installation of elastomeric flashing conditions.
- E. Install approved sealant over tears, holes and all fasteners not located at framing members.
- F. Metal suspension system:
 1. Install in accordance with CBC Chapter 7A and as required by DSA.

3.3 INSTALLING METAL LATH

- A. Lath installation at vertical and sloped framing:
 1. Apply specified metal lath over underlayment.
 - a. Install with metal lath in contact with metal lath. Ensure paper selvage edges are properly lapped. Do not permit lath to be sandwiched or covered by underlayment.
 2. Apply metal lath taut, with long dimension perpendicular to supports. Install lath a minimum of 1/4 inch from backing with approved fasteners, anchored through sheathing into framing or blocking only. Do not fasten lath to sheathing.
 3. Lap metal lath edges minimum 1-1/2 inches, lapped as recommended by manufacturer and secure with tie wire at 6 inches on center.
 4. Attach metal lath to supports in conformance with CBC Chapter 25 and ASTM C 1063.
 - a. Install approved sealant over tears, holes and all fasteners not located at framing members.
 - b. Install lath using approved drilled in mechanical fasteners where lath is shown extending over masonry or concrete, including wall curbs.
 5. Continuously reinforce internal angles with specified corner expansion screeds. Fasten at perimeter edges only.
 6. Install specified outside corner reinforcing. Fasten only at flange or outer edges.
 7. Place 4 x 12 inch strip of corner reinforcing lath diagonally at corners of openings. Secure rigidly in place.
 8. Place 4 inch wide strips of corner reinforcing lath centered over junctions of dissimilar backing materials. Secure rigidly in place.
- B. Lath installation at horizontal soffits:
 1. Apply paper backed metal lath taut, with long dimension perpendicular to supports in accordance with CBC Chapter 25, including Section 2507.3.
 - a. Ensure paper selvage edges are properly lapped. Do not permit lath to be sandwiched or covered by underlayment.
 2. Lap ends and sides of metal lath minimum 1-1/2 inches. Secure laps with tie wire where they occur between supports.
 3. In addition to fastening methods required by CBC Chapter 25, provide 9 gage ring shank hook staple over 10d nail, at 27 inches on-center along joist support, and located not more than 3 inches from edge of lath.
 4. Place 4 x 12 inch strip of corner reinforcement lath diagonally at corners of openings and recessed light fixture frames. Secure rigidly in place.

3.4 INSTALLING ACCESSORIES:

- A. Place specified plaster accessories at terminations of plaster finish per ASTM C 1063.
- B. Neatly miter or cope, corners and intersections of accessories to fit exposed edges.
- C. Caulk drip screeds and other exterior accessories at joints and intersections
- D. Secure in place by wire tying to lath. Do not anchor to plywood sheathing or supports without Architects prior approval.
- E. Where available from manufacturer, provide manufacturer's recommended connector clip and sealant bedding at all accessory intersections and joints.
- F. Where available from manufacturer, provide manufacturer's end cap at locations where accessories terminate against door frames, wall surfaces and similar conditions.
- G. Install specified weep screed at bottom edge of plaster. Fasten to backing or sill with fully seated screws at 16 inches on center.
- H. Install accessories to proper lines and levels. Provide 1/8 inch spacing at joints. Align intersections.
- I. Establish control and expansion joints with specified joint devices. Do NOT allow lath to continue behind or through expansion joint.
- J. Coordinate joint placement with naturally occurring joints of other related work. Do not extend lath across expansion or control joints in substrate.
- K. Lath and Underlayment Installation at Accessories:
- L. Provide additional layer of water-resistant underlayment behind all accessories, 12 inches wide, centered on accessory. Apply over lower layer of wall underlayment.
- M. In horizontal applications at wall conditions, install lath and underlayment over upper flange of accessory. Install lath over lower flange of accessory. Extend wall underlayment a minimum of 6 inches above upper flange.
- N. In vertical applications at wall conditions and soffit conditions, install lath over flange of accessory. Maintain wall underlayment behind accessory.
- O. Provide joints as shown on drawings. Where joints not shown, provide as directed by Architect in compliance with the following criteria:
- P. Extend screeds and accessories into niches and recesses, around interior and exterior wall corners, and around all sides of columns and similar building elements. Continue control joint patterns and molding alignments on walls of arcades, passages and all similar locations to match or extend those shown on exterior elevations, whether or not individual conditions are specifically shown, noted or elevated.
- Q. Provide wall control joint at edge of door and window frames, extended from drip screed to continuous horizontal control joint.
- R. Provide vertical wall control joints as necessary to limit plaster area to approximately 140 square feet, with maximum joint spacing dimension of 18 feet, and with maximum 2-1/2 to 1 aspect ratio. Coordinate area limit with horizontal joint location. Final location as directed by Architect.

- S. Provide horizontal wall control joint in coordination with vertical joint spacing as necessary to limit plaster area as defined for vertical joints. Final location as directed by Architect.
- T. In plastered ceilings and soffits, provide control joints as necessary to limit plaster area to approximately 75 square feet. Final location as directed by Architect.

3.5 PLASTERING APPLICATION RAPID SET

- A. Apply plaster in accordance with ICC ESR 2671, referenced TSIB Tech Bulletins, CBC Chapter 25 and ASTM C 926.
- B. Framed wall application:
 - 1. Apply three-coat plaster assembly, resulting in minimum 7/8 inch nominal thickness.
 - 2. Apply scratch coat to a nominal thickness of 3/8 inch.
 - 3. Apply brown coat to a nominal thickness of 3/8 inch. Texture as required to comply with specified texture.
 - 4. At Contractors option, basecoat may be applied in two coats, 3/8 inch thickness each, with the second coat being applied as soon as the first coat has attained sufficient rigidity to accept the mechanical force of application without damage. See curing criteria specified in this Section.
 - 5. Rod surface of brown coat with a 10 foot straight edge to produce a true plane. Texture as required to comply with specified texture.
 - 6. Apply finish coat to a nominal thickness of 1/8 inch.
- C. Curing of basecoat plaster:
 - 1. RapidSet basecoat plaster curing: Comply with ICC ESR 2671, including moist cure of scratch and brown basecoat for minimum 2 hours with light fog of clean, potable water as required to maintain wet sheen.
 - 2. Complete curing documentation as required by ESR 2671.
- D. Finish Coat
 - 1. After basecoat curing is complete, apply finish coat. Dampen base coat prior to applying finish coat.
 - 2. Exterior Surfaces:
 - a. Apply finish coat in sand super fine with plastic float finish as illustrated in "Plaster Textures" published by TSIB and matching approved sample.
 - 3. At soffits and ceilings, provide a combined thickness of 7/8 inch thickness at scratch and brown coats prior to application of finish coat.
 - a. Apply finish coat in sand super fine with plastic float finish as illustrated in "Plaster Textures" published by TSIB and matching approved sample
- E. Concrete and Masonry wall application:
 - 1. Apply two- coat plaster to concrete and masonry wall surfaces, resulting in 5/8 inch nominal thickness. Concrete: maximum 7/8 inch thick, CMU minimum 1/2 inch.
 - 2. Apply specified bonding agent and dash coat as necessary for proper adhesion.
 - 3. Apply brown coat to a thickness of 1/2 inch. Texture as required to comply with specified texture.
 - 4. Apply finish coat to a thickness of 1/8 inch, with sand super fine with plastic float finish as illustrated in "Plaster Textures" published by TSIB and matching approved sample.

3.6 PLASTERING APPLICATION NON RAPID SET

- A. Apply plaster in accordance with referenced TSIB Tech Bulletins, CBC Chapter 25 and ASTM C 926.

- B. Framed wall application:
 - 1. Apply three-coat plaster assembly, resulting in minimum 7/8 inch nominal thickness.
 - 2. Apply scratch coat to a nominal thickness of 3/8 inch.
 - 3. Apply brown coat to a nominal thickness of 3/8 inch. Texture as required to comply with specified texture.
 - 4. Rod surface of brown coat with a 10 foot straight edge to produce a true plane. Texture as required to comply with specified texture.
 - 5. Apply finish coat to a nominal thickness of 1/8 inch.
- C. Concrete and Masonry wall application:
 - 1. Apply two- coat plaster to concrete and masonry wall surfaces, resulting in 5/8 inch nominal thickness. Concrete: maximum 7/8 inch thick, CMU minimum 1/2 inch.
 - 2. Apply specified bonding agent and dash coat as necessary for proper adhesion.
 - 3. Apply brown coat to a thickness of 1/2 inch. Texture as required to comply with specified texture.
 - 4. Apply finish coat to a thickness of 1/8 inch, texture as specified.
- D. At soffits and ceilings, provide a combined thickness of 7/8 inch thickness at scratch and brown coats prior to application of finish coat.
 - 1. Apply finish coat in sand super fine with plastic float finish as illustrated in "Plaster Textures" published by TSIB and matching approved sample
- E. Curing:
 - 1. Moist cure scratch coat a minimum of 5 days prior to application of brown coat.
 - 2. Dampen surface of scratch coat prior to application of brown coat.
 - 3. Moist cure brown coat a minimum of 5 days, and cure for a total of 10 days prior to application of finish coat.
 - 4. Moist cure finish coat for minimum period of 72 hours.
- F. Finish Coat:
 - 1. After brown coat curing time has elapsed, apply finish coat. Dampen base coat prior to applying finish coat.
 - 2. Exterior Surfaces:
 - a. Apply finish coat in sand super fine with plastic float finish as illustrated in "Plaster Textures" published by TSIB and matching approved sample.
 - 3. Interior Surfaces: Apply finish coat in two- coat process. Use wood float to a smooth and consistent fine sand float finish, as illustrated in "Plaster Textures" published by TSIB and matching approved sample.

3.7 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.

3.8 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 092900 - GYPSUM BOARD

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. Interior gypsum board.
 - 2. Tile backing panels.
 - 3. Exterior gypsum sheathing.
 - 4. Sound barrier wall end cap.
- B. Related Requirements:
 - 1. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for metal shaft-wall framing, gypsum shaft liners, and other components of shaft-wall assemblies.
 - 2. Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.
 - 3. Section 093000 "Ceramic Tiling" for backer units installed as substrates for ceramic tile.

1.3 ACTION SUBMITTALS

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

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. 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.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written instructions, 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, 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 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.
- C. Suspended gypsum board ceiling systems shall comply with DSA IR-25-3.13.

2.2 GYPSUM BOARD, GENERAL

- A. 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. Gypsum Wallboard: ASTM C 1396/C 1396M.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. National Gypsum Company.
 - b. PABCO Gypsum.
 - c. United States Gypsum Company.
 - d. Or equal.
 - 2. Thickness: 5/8 inch.
 - 3. Long Edges: Tapered.
- B. Gypsum Board, Type X: ASTM C 1396/C 1396M.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. National Gypsum Company.
 - b. PABCO Gypsum.
 - c. United States Gypsum Company.
 - d. Or equal.
 - 2. Thickness: 5/8 inch.
 - 3. Long Edges: Tapered.
- C. Flexible Gypsum Board: ASTM C 1396/C 1396M. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation.
 - b. National Gypsum Company.
 - c. United States Gypsum Company.
 - d. Or equal.
 - 2. Thickness: 1/4 inch.
 - 3. Long Edges: Tapered.
- D. Impact-Resistant Gypsum Board: ASTM C 1396/C 1396M gypsum board, tested according to ASTM C 1629/C 1629M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. National Gypsum Company.
 - b. PABCO Gypsum.
 - c. United States Gypsum Company.
 - d. Or equal.
 - e.
2. Panel Physical Characteristics
 - a. Core: Fire-resistance rated gypsum core, with additives to enhance mold/mildew resistance, surface indentation resistance, impact resistance and moisture and mold resistant
 - b. Surface paper: Abrasion resistant, 100 percent recycled content moisture/mold/mildew resistant paper on front, back and long edges
 - c. Embedded fiberglass mesh
 - d. Long Edges: Tapered
 - e. Overall thickness: 5/8 inch
 - f. Panel complies with Type X requirements of ASTM C 1396
 - g. Surface Abrasion Resistance: Classification Level 3 in accordance with ASTM C 1629
 - h. Indentation Resistance: Classification Level 1 in accordance with ASTM C 1629.
 - i. Soft Body Impact Resistance: Classification Level 3 in accordance with ASTM C 1629
 - j. Hard Body Impact Resistance: Classification Level 3 in accordance with ASTM C 1629.
 - k. Mold/Mildew Resistance: 10 when tested in accordance with ASTM D 3273.

2.4 TILE BACKING PANELS

- A. Glass-Matte, Water-Resistant Gypsum Backing Board: ASTM C 1178/C 1178/M, with manufacturer's standard edges.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Georgia-Pacific Building Products.
 - b. National Gypsum Company.
 - c. United States Gypsum Company.
 - d. Or equal.
 2. Core: 5/8 inch, regular type or 5/8 inch, Type X.
 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 or rolled zinc.
 2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. L-Bead: L-shaped; exposed long flange receives joint compound.
 - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - f. Expansion (control) joint.
 - g. Curved-Edge Cornerbead: With notched or flexible flanges.

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, rounded or beveled panel edges, 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 drying-type, all-purpose compound.
 - 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
 - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
 - 5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.
- D. Joint Compound for Tile Backing Panels:
 - 1. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

2.7 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. 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.
- C. Isolation Strip at Exterior Walls:
 - 1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
- 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.
- E. Acoustical 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hilti, Inc.
 - b. Pecora Corporation.
 - c. United States Gypsum Company.
 - d. Or equal.
- F. Thermal Insulation: As specified in Section 07 21 00 "Thermal Insulation."

2.8 EXTERIOR GYPSUM SHEATHING

- A. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M, with fiberglass mat laminated to both sides and with manufacturer's standard edges.
 - 1. Products: Subject to compliance with requirements, provide the following or equal:
 - a. Georgia-Pacific Gypsum LLC; equal to Dens-Glass Gold.
 - b. National Gypsum Company.
 - c. United States Gypsum Company.
 - d. Or equal.
 - 2. Core: 5/8 inch, Type X.

2.9 SOUND BARRIER WALL END CAP

- A. General: Sound barrier mullion trim caps of design, basic profile, materials, and operation indicated. Units shall have capability to accommodate variations in adjacent surfaces.
 - 1. Products: Subject to compliance with requirements, provide the following or equal:
 - a. MULL-it-OVER Products; Sound barrier mullion trim cap systems.
 - b. Or equal.
 - 2. Profile: 55 Classic Mullion Trim Cap, 55 Flush Mullion Trim Cap, and 55 Wide Mullion Trim Cap.
 - 3. Sound Transmission: STC 55 or higher.
 - 4. Color: Light gray.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- 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. 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. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.
- J. 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 instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- K. 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: As indicated on Drawings Apply in double layer at curved assemblies.
 4. Abuse-Resistant Type: 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 vertically (parallel to framing) 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-shaped 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-shaped 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.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws, use screws of proper length when fastening gypsum board to framing, spaced at 8 inches on center maximum at each support..

D. 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. Water-Resistant Backing Board: Install where indicated with 1/4-inch gap where panels abut other construction or penetrations.
- B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 APPLYING EXTERIOR GYPSUM SHEATHING

1. Install gypsum sheathing in accordance with manufacturer's recommendations. Install boards with correct side to exterior.
2. Install board with joints over supports. Space ends and edges 1/8 inch apart.
3. Install board using approved fasteners at maximum 8 inches on center at each support.
4. Apply approved sealant at sheathing edges and penetrations. Coordinate all joint treatments with specified air and or water barrier.
5. Entire face of gypsum sheathing shall be covered with weather barrier.
6. Apply panels perpendicular to supports, with end joints staggered and located over supports.
7. Fasten with corrosion-resistant screws.

3.6 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
 1. Cornerbead: Use at outside corners unless otherwise indicated.

2. LC-Bead: Use at exposed panel edges.
 3. L-Bead: Use where indicated.
 4. U-Bead: Use at exposed panel edges.
- D. Install acoustical sealant at wall edge perimeter, including floor edge, and at all penetrations where fire stopping is not required.
- E. Control Joints: Install control joints at locations indicated on Drawings and according to ASTM C 840.
1. Wall control joints shall be installed where a wall partition runs in an uninterrupted straight plane exceeding 30 linear feet. At fire rated walls use detail per drawings to maintain rating.
 2. Ceiling control joints shall be installed where a ceiling run exceeds 30 linear feet.
- 3.7 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.
- D. 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 Panels that are substrate for acoustical tile Where indicated on Drawings.
 - a. Embed tape at all joints and interior angles in joint compound.
 - b. Apply one separate coat of joint compound over all joints, angles, fastener heads, and accessories.
 - c. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable.
 3. Level 3: Gypsum board designated to receive rigid FRP or solid paneling.
 - a. Embed tape at all joints and interior angles in joint compound.
 - b. Apply two separate coats of joint compound over all joints, angles, fastener heads, and accessories.
 - c. All joint compound shall be smooth and free of tool marks and ridges.
 - d. Apply uniform coat of approved primer over entire surface with roller.
 4. Level 4 - Smooth Finish: Gypsum board surfaces receiving eggshell, semi-gloss or gloss level paint finish.
 - a. Embed tape at all joints and interior angles in joint compound.
 - b. Apply three separate coats of joint compound over all joints, angles, fastener heads, and accessories. Apply uniform coat of approved primer over entire surface with roller.
 - c. Surface shall be smooth and free of tool marks and ridges.
 - d. Primer and its application to surfaces are specified in Section 099123 "Interior Painting".
 5. Level 5: Gypsum board designated to receive vinyl wall covering or walltalker.
 - a. Embed tape at all joints and interior angles in joint compound.

- b. Apply three separate coats of joint compound over all joints, angles, fastener heads, and accessories.
 - c. Surface shall be smooth and free of tool marks and ridges.
 - d. Apply uniform coat of approved primer over entire surface with roller.
- E. Tile Backer Units: Finish according to manufacturer's written instructions.

3.8 APPLYING TEXTURE FINISHES

- A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.
- B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture free of starved spots or other evidence of thin application or of application patterns.
- C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written instructions.

3.9 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 093000 - TILING

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. Ceramic tile.
 - 2. Glazed wall tile.
 - 3. Quarry tile.
 - 4. Stone thresholds.
 - 5. Waterproof membrane.
 - 6. Crack isolation membrane.
 - 7. Metal edge strips.
- B. Tile installation
 - 1. Thin set tile at walls.
 - 2. Full mortar set at floors.

1.3 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."
- C. Module Size: Actual tile size plus joint width indicated.
- D. Face Size: Actual tile size, excluding spacer lugs.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.
- D. Samples for Verification:
 - 1. Full-size units of each type and composition of tile and for each color and finish required.
 - 2. Full-size units of each type of trim and accessory for each color and finish required.
 - 3. Stone thresholds in 6-inch lengths.
 - 4. Metal edge strips in 6-inch lengths.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- C. Product Certificates: For each type of product, signed by product manufacturer.
- D. Material Test Reports: For each tile-setting and -grouting product.
- E. Certification
 - 1. Prior to installation of tile in any one area, submit written certification to Architect certifying that surfaces are properly prepared for specified installation, and that all depressions and abutting edges are properly spaced and aligned to permit installation in pattern shown on drawings.
 - 2. Submit certification that selected detectable warning tile complies with requirements of the Americans with Disabilities Act of 1990.
 - 3. Submit certification that selected sealant specified in Section 079200 will achieve manufacturer's published adhesion values on specified tile.
 - 4. Slip Resistance Testing: Test six representative tile from each tile specified, selected at random from project stock per ASTM C1028 to verify compliance with slip resistance criteria.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Tile and Trim Units: Furnish one case of each tile type.

1.7 QUALITY ASSURANCE

- A. Source Limitations for Tile: Obtain tile of each type from one source or producer.
 - 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
 - 1. Stone thresholds.
 - 2. Waterproof membrane.
 - 3. Crack isolation membrane.
 - 4. Joint sealants.
 - 5. Cementitious backer units.
 - 6. Metal edge strips.
- D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Mock-up: Prior to beginning tile on typical toilet wall and floor surface, prepare in-place mock-up of portion of installation and obtain Architect's approval.

2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- 1.8 Retain paragraph below if Work of this Section is extensive or complex enough to justify a preinstallation conference. Qualifications
 - A. Manufacturer:
 1. Manufacturer shall have produced tile products of similar type for a period of five (5) years prior to beginning work of this section, and shall have the capability to produce the specified products to the delivery and quantity criteria of the project.
 - B. Staff:
 1. Use only personnel thoroughly trained and experienced in the skills required, have installed similar applications of the specified products within one year prior to beginning work of this section, and are completely familiar with the manufacturers' recommended methods of installation as well as the requirements of this work.
 2. Staff installing specified grout shall have attended manufacturer's training sessions and have installed specified grout within the past 12 months prior to beginning work.
- 1.9 DELIVERY, STORAGE, AND HANDLING
 - A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
 - B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
 - C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
 - D. Store liquid materials in unopened containers and protected from freezing.
 - E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.
- 1.10 PROJECT CONDITIONS
 - A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.
- 1.11 REGULATORY REQUIREMENTS
 - A. Ceramic Tile Flooring demonstrating a coefficient of friction of at least 0.6 per ASTM C1028 shall be accepted as meeting the intent of slip resistance. CBC Section 11B-302.1.

PART 2 - PRODUCTS

- 2.1 PRODUCTS, GENERAL
 - A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
 1. Provide tile complying with Standard grade requirements unless otherwise indicated.
 - B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by

TCA installation methods specified in tile installation schedules, and other requirements specified.

- C. FloorScore Compliance: Tile for floors shall comply with requirements of FloorScore Standard.
- D. Low-Emitting Materials: Tile flooring systems shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- F. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
- G. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.2 TILE PRODUCTS

- A. Tile Type CT-1: Glazed wall tile.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:
 - a. Daltile; Division of Dal-Tile International Inc., Daltile Glazed Ceramic Volume 1.0.
 - 2. Module Size: 12 by 24 inches
 - 3. Thickness: 5/16 inch.
- B. Tile Type CTB-2: Cove Base
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:
 - a. Daltile; Division of Dal-Tile International Inc., Daltile S-36C9.
 - b. Module Size: 6 inches by 12 inches.
- C. Tile Type CT-2: Interior Floor Tile
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:
 - a. Dal-Tile; Division of Dal-Tile International Inc., Volume 1.0.
 - b. Module Size: 12 by 24 inches.
 - c. Coefficient of Friction: Minimum 0.60, wet and dry per, ASTM C1028.

2.3 THRESHOLDS

- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
 - 1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.
- B. Marble Thresholds: ASTM C 503, with ASTM C 241 and with honed finish.
 - 1. Description: Color and profile as selected by Architect..

2.4 WATERPROOF MEMBRANE

- A. Mortar Bed Waterproofing Applications: NobleSeal Chloraloy 240, preformed sheet CPE membrane, 40 mil thickness. Provide preformed corners and all manufacturers recommended accessories.

2.5 CRACK ISOLATION MEMBRANE

- A. General: Manufacturer's standard product that complies with ANSI A118.12 for high performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

2.6 SETTING MATERIALS

- A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.
 - 1. Cleavage Membrane: Asphalt felt, ASTM D 226, Type I; or polyethylene sheeting, ASTM D 4397, 4.0 mils thick.
- B. Cementitious Tile Adhesives Interior (Interior Glass Mosaic Tile):
 - 1. Tile adhesive requires a minimum "Shear Bond" strength after 28 days of 425 PSI for porcelain tile and 600 PSI for bisque tile.
 - 2. ANSI A118.4: Polymer-Enhanced Mortars:
 - a. Custom Building Products ProLite Tile White Cement and Stone Thin-Set Mortar.
- C. Cementitious Tile Adhesives Interior (Interior Colored Body Porcelain Tile):
 - 1. Tile adhesive requires a minimum "Shear Bond" strength after 28 days of 350 PSI for porcelain tile and 575 PSI for bisque tile.
 - 2. ANSI A118.4: Polymer-Enhanced Mortars:
 - a. Custom Building Products VersaBond Flex Fortified Thin-Set Mortar.

2.7 GROUT MATERIALS

- A. Grout (Interior Glass Mosaic Tile): Where indicated on the drawings, and elsewhere as required for filling the joints between tiles.
 - 1. Tile grout requires a minimum "Tinsel Strength" after 28 days of 525 PSI.
 - 2. Polymer-Modified Glass Aggregate Portland Cement Grout:
 - a. Custom Building Products Polyblend Non Sanded Tile Grout; ANSI A118.6, for joints 1/16" (1.5 mm) - 1/8 inch.
- B. Grout (Interior Colored Body Porcelain Tile): Where indicated on the drawings, and elsewhere as required for filling the joints between tiles.
 - 1. Tile grout requires a minimum "Tinsel Strength" after 28 days of 500 PSI.
 - 2. Polymer-Modified Glass Aggregate Portland Cement Grout:
 - a. Custom Building Products Prism SureColor Tile Grout, ANSI A118.7 for joints 1/16 inch to 1/2 inch.

2.8 ELASTOMERIC SEALANTS

- A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Section 079200 "Joint Sealants."
 - 1. Sealants shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
 3. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.
- B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.
- C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.

2.9 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless-steel, ASTM A 666, 300 Series exposed-edge material.
1. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.
- C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- D. Grout Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.
1. Products: Subject to compliance with requirements, provide one of the following or equal:
 - a. Custom Building Products; Surfaceguard Sealer.

2.10 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances

- that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with bonded mortar bed or thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
 - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
 - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- 3.2 PREPARATION
- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
 - B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.
 - C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
 - D. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.
- 3.3 MEMBRANE INSTALLATION
- A. Verify slab preparation complies with criteria specified in Section 033000.
 1. Remove all sealers, curing compounds and other materials affecting proper bond of membranes with bead blast abrasive equipment.
 - B. Cleavage Membrane: Unless otherwise shown on drawings, where mortar bed is installed over concrete slab on grade at interior applications, provide specified cleavage membrane.
 - C. Waterproofing Membrane Installation:
 1. Apply waterproofing membrane per manufacturers recommendations.
 - a. Apply thinset waterproofing membrane using approved latex modified mortar system.
 2. Provide preformed corners. Seal all penetrations with specified sealant.
 3. Detail all joints as required by manufacturer and approved submittal.
 4. Extend membrane up wall surface as shown on drawings. Coordinate with wall underlayment.
 5. At expansion joints, continue sheet material in looped fashion through joint to accommodate anticipated joint movement.

6. Allow sufficient time for all seams, transitions and setting beds to cure before installing subsequent materials. Do not install tile over waterproofing until waterproofing has been tested to determine that it is watertight.

3.4 MORTAR BED INSTALLATION

- A. Unless noted otherwise, prepare floor substrate as required for complete bond. Remove all sealers, curing compounds and other materials affecting proper bond of membranes with bead blast abrasive equipment.
- B. Coordinate lath and mortar bed installation with concrete slab substrate joints. Align expansion joints in mortar bed and tile with substrate joints.
- C. Install mortar bed in accordance with specified method and referenced ANSI standard.
- D. Where waterproof membrane is provided, do not penetrate membrane. Provide accessory supports.

3.5 TILE INSTALLATION

- A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
 1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:
 - a. Tile floors in wet areas.
 - b. Tile floors composed of tiles 8 by 8 inches or larger.
 - c. Tile floors composed of rib-backed tiles.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
 2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
 1. Ceramic Mosaic Tile: 1/16 inch.

2. Paver Tile: 1/4 inch.
 3. Glazed Wall Tile: 1/16 inch.
 4. Decorative Thin Wall Tile: 1/16 inch.
- G. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- H. Expansion Joints: Provide expansion joints complying with TCNA Detail EJ171 at the following specified locations and as located and shown on the drawings:
1. At wall tile to paver/floor tile joints.
 2. At all expansion and control joints in substrate. Where tile joint does not occur directly over substrate joint, provide sealant joint on each side of joint.
 3. At tile joint at inside vertical corners.
 4. At interior applications, at approximately 24 feet on center each way in floor and wall tile surfaces. Adjust to 12 feet at toilet tile conditions, and 8 feet for dark tile in sunlight areas.
 5. At exterior applications, at approximately 12 feet on center each way in floor and wall tile surfaces. Adjust to 8 feet as necessary for dark tile in sunlight areas.
 6. Where material transitions occur, comply with expansion/control joint criteria.
 7. At conditions where tile extends through doorways, extend wall cove/floor tile sealant joint across doorway.
 8. At floor drain/tile edge, column penetrations, tile terminations against frames and other restraining elements.
 9. At tile terminations against curbs, paving or other restraining elements.
- I. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- J. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in latex-portland cement mortar (thin set).
- K. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.
- L. Grout Sealer: Apply grout sealer to grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.
- 3.6 WATERPROOFING INSTALLATION
- A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.
 - B. Do not install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.
- 3.7 CRACK ISOLATION MEMBRANE INSTALLATION
- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.
 - B. Do not install tile or setting materials over crack isolation membrane until membrane has cured.
- 3.8 FIELD QUALITY CONTROL
- A. Tolerances

1. Grout joint alignment with adjacent edge: 1/8" in 10 feet.
2. Row and column alignment: 1/8" in 10 feet deviation.
3. Alignment with adjacent tile: 1/16" +/-.
4. Level, plane and/or vertical: 1/8" in 10 feet deviation.

3.9 CLEANING AND PROTECTING

- A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 1. Remove epoxy and latex-portland cement grout residue from tile as soon as possible.
 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
 3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.
- B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.10 INTERIOR TILE INSTALLATION SCHEDULE

- A. Interior Floor Installations, Concrete Subfloor:
 1. Tile Installation F111: Cement mortar bed (thickset) with cleavage membrane; TCA F111 and ANSI A108.1C.
- B. Interior Wall Installations, Metal Studs or Furring:
 1. Tile Installation W244: Thin-set mortar on cementitious backer units or fiber cement underlayment over cleavage membrane; TCA W244.

END OF SECTION 093000

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

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 acoustical panels and exposed suspension systems for ceilings.

1.3 SYSTEM DESCRIPTION

- A. Installed System: Conform to ASTM C635, C636, E580 Section 5 and DSA IR-25-2.13.
- B. Ceiling Suspension System complying with requirements of Chapter 16A, Part 2, Title 24, CCR, including 1616A.1.20, modifications to ASCE 7, Section 13.5.6.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.
- C. Samples for Initial Selection: For components with factory-applied color finishes.
- D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
 - 1. Acoustical Panel: Set of 6-inch- square Samples of each type, color, pattern, and texture.
 - 2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- long Samples of each type, finish, and color.

1.5 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. Qualification Data: For testing agency.
- C. Product Test Reports: For each acoustical panel ceiling, for tests performed by a qualified testing agency.
- D. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

1.6 WARRANTY

- A. Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace acoustical panels that fail within the warranty period. Failures include, but are not limited to:
 - 1. Acoustical Panels: Sagging and warping as a result of defects in materials or factory workmanship.
 - 2. Grid System: Rusting and manufacturer's defects
 - 3. Acoustical Panels with BioBlock Plus or designated as inherently resistive to the growth of micro-organisms installed with Armstrong suspension systems exhibiting growth of mold/mildew and gram positive and gram negative odor and stain causing bacteria.
- B. Warranty Period:
 - 1. Acoustical panels: Ten (10) year from date of substantial completion.
 - 2. Grid: Ten years from date of substantial completion.

1.7 CLOSEOUT SUBMITTALS

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

1.8 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: Provide two unopened boxes of each type of acoustical panel.

1.9 QUALITY ASSURANCE

- A. Installer: Company with three years minimum documented experience with projects under the jurisdiction of DSA.

1.10 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.

1.11 FIELD 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 ACOUSTICAL PANELS, GENERAL

- A. Low-Emitting Materials: Acoustical panel ceilings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the

Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

- B. Source Limitations:
 - 1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.
 - 2. Suspension System: Obtain each type from single source from single manufacturer.
- C. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.
- D. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.
- E. 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.

2.2 CEILING SUSPENSION SYSTEM

- A. Manufacturer: Armstrong World Industries, Inc., www.armstrong.com. or equal.
- B. Series:
 - 1. Standard Face Series - Type 1: Prelude 7301 15/16 inch.
- C. Duty Rating: Heavy Duty per ASTM C635.
- D. Fire Resistance Rating: Non-rated assembly.
- E. Color: Painted finish, as selected from standard line.
- F. Support/Fastening System: Components of size and type as shown in the drawings or identified in DSA IR 25-2.10 (04/08/14), as required to rigidly secure acoustic ceiling system with maximum deflection of 1/360.
- G. Compression Strut: Provide vertical compression strut at grid in accordance with DSA IR 25-2.13 and as shown on drawings.
- H. Perimeter Edge Trim: Armstrong Axiom - Classic straight trim 6 inch.

2.3 ACOUSTICAL PANELS ACP-1

- A. Manufacturers: Subject to compliance with requirements, provide products by the following or equal:
 - 1. Armstrong World Industries, Inc.
- B. Series: School Zone - Fine Fissured
- C. Style: 1820.
 - 1. Edge: Angled tegular.
- D. Fire/Habitability Criteria:
 - 1. Fire Resistance Rating: Class A per ASTM E1264, maximum Flame Spread of 25, maximum smoke contributed of 450, UL Labeled.
- E. Color: White .
- F. LR: Not less than 0.85.
- G. NRC: Not less than 0.70 .

- H. CAC: Not less than 35.
- I. Thickness: 3/4 inch.
- J. Modular Size: 24 by 24 inches.
- K. 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 EDGE MOLDINGS AND TRIM

- A. Manufacturers: Subject to compliance with requirements, provide products by the following or equal:
 - 1. Armstrong World Industries, Inc.
- B. 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 circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
- C. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements and the following:
 - 1. Aluminum Alloy: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of aluminum extrusions complying with ASTM B 221 for Alloy and Temper 6063-T5.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels 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 to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M, ASTM E580 and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook." and as modified by IR-25-2, including required vertical compression struts.
- B. Install system capable of supporting imposed loads to a deflection of 1/360 maximum.
- C. Install after major above ceiling work is complete. Coordinate the location of hangers with other work.
- D. Install after major above ceiling work is complete. Coordinate the location of hangers with other work.
- E. 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. 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.
- F. 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. Crimp or tightly twist wire ends around wire support. Do not leave ends angled away from line of wire support.
- G. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
- H. Install edge molding at intersection of ceiling and vertical surfaces, using longest practical lengths. Miter corners. Provide edge moldings at junctions with other interruptions. Where round obstructions occur, provide preformed closers to match edge molding.
 - 1. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
 - 2. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- I. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- J. Locate system on room axis leaving equal border units according to reflected ceiling plan.
- K. 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. Install panels in accordance with the manufacturer's instructions, and in compliance with ASTM C 636 & ASTM E580 and with the authorities having jurisdiction.
2. Install acoustical panels in coordination with suspended system, with edges resting on flanges of main runner and cross tees. Cut and fit panels neatly against abutting surfaces. Support edges by wall moldings.
3. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
4. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
5. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
6. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
7. Install **hold-down** clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions unless otherwise indicated.

3.4 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 096513- RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Resilient base.
 - 2. Rubber molding accessories.
- B. Related Requirements:
 - 1. Section 096519 "Resilient Tile Flooring".

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, not less than 12 inches long.
- C. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.6 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 THERMOSET-RUBBER BASE RB-1

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Burke Mercer Flooring Products; a division of Burke Industries Inc.
 - 2. Flexco.
 - 3. Roppe Corporation, USA.
 - 4. Or Equal.
- B. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
 - 1. Style and Location:
 - a. Style A, Straight: Provide in areas with carpet.
 - b. Style B, Cove: Provide in areas with resilient flooring.
- C. Thickness: 0.125 inch.
- D. Height: 4 inches.
- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: Non preformed.
- G. Inside Corners: Non preformed.
- H. Colors: As selected by Architect from full range of industry colors.

2.2 RUBBER MOLDING ACCESSORY

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Johnsonite; A Tarkett Company.
 - 2. Roppe Corporation, USA.
 - 3. VPI Corporation.
 - 4. Or Equal.
- B. Description: Rubber reducer strip for resilient flooring and 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 from full range of industry colors.

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 resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
 - 1. VOC Content: Adhesives shall comply with the testing and product requirements of San Diego Air Pollution Control District Rule 67.0 "Architectural Coatings" and Rule 67.21 Adhesive Material Application Operations. •

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. Job-Formed Inside Corners:
 - 1. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Miter 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.
 - 2. Sweep and vacuum horizontal surfaces thoroughly.
 - 3. Damp-mop horizontal surfaces to remove marks and soil.
- 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 096816 - SHEET CARPETING

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. Tufted carpet.
 - 2. Walk-off-mats.
- B. Related Requirements:
 - 1. Section 033000 "Cast-in-Place Concrete".
 - 2. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to carpet installation including, but not limited to, the following:
 - a. Review delivery, storage, and handling procedures.
 - b. Review ambient conditions and ventilation procedures.
 - c. Review subfloor preparation procedures.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written data on physical characteristics and durability.
 - 2. Include manufacturer's written installation recommendations for each type of substrate.
 - 3. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency.
- B. Shop Drawings: For carpet installation, showing the following:
 - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
 - 2. Carpet type, color, and dye lot.
 - 3. Locations where dye lot changes occur.
 - 4. Seam locations, types, and methods.
 - 5. Type of subfloor.
 - 6. Type of installation.
 - 7. Pattern type, repeat size, location, direction, and starting point.
 - 8. Pile direction.
 - 9. Types, colors, and locations of insets and borders.
 - 10. Types, colors, and locations of edge, transition, and other accessory strips.
 - 11. Transition details to other flooring materials.
- C. Samples for Initial Selection: For each type of product.

1. Include Samples of exposed edge, transition, and other accessory stripping involving color or finish selection.
 - D. Samples for Verification: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
 1. Carpet: 12-inch-square sample.
 2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch-long samples.
 3. Carpet Seam: 6-inch Sample.
 4. Mitered Carpet-Border Seam: 12-inch-square sample. Show carpet pattern alignment.
 - E. Product Schedule: For carpet. Use same designations indicated on Drawings.
- 1.5 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For Installer.
 - B. Product Test Reports: For carpet, for tests performed by a qualified testing agency.
 - C. Sample Warranty.
- 1.6 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For carpet to include in maintenance manuals. Include the following:
 1. Methods for maintaining carpet, 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.
- 1.7 REGULATORY REQUIREMENTS
- 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 ½ maximum.
 - 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.
- 1.8 QUALITY ASSURANCE
- A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level, or who can demonstrate compliance with its certification program requirements.
- 1.9 DELIVERY, STORAGE, AND HANDLING
- A. Comply with CRI's "CRI Carpet Installation Standard."
 - B. Deliver carpet in original mill protective covering with mill register numbers and tags attached.
- 1.10 FIELD CONDITIONS
- A. Comply with CRI's "CRI Carpet Installation Standard" for temperature, humidity, and ventilation limitations.
 - B. Environmental Limitations: Do not deliver or install carpet until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

- C. Do not install carpet over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.

1.11 WARRANTY

- A. Manufacturer's standard non-prorated warranty in which manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, the following:
 - a. More than 15 percent loss of face fiber, edge raveling, snags, and runs.
 - b. Loss of tuft bind strength.
 - c. Loss of face fiber.
 - d. Excess static discharge. More than 3.0 kV per AATCC 134.
 - e. Resiliency Loss of Backing: More than 10-percent loss of backing resiliency.
 - f. Delamination.
 - g. Edge Ravel
 - h. Zippering.
 - 3. Chair pads are not required for carpet warranty coverage.
 - 4. All carpet warranties to be sole responsibility of the Manufacturer. Second source warranties or warranties that involve parties other than the Manufacturer are unacceptable.
 - 5. Warranty Period: Lifetime limited warranty.
 - 6. Warranty shall be signed by a company representative and shall be notarized.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and CBC Section 11B-302.2.

2.2 VINYL CUSHIONED TUFTED CARPET CPT-1

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Tandus; a Tarkett company.
 - 2. Or equal.
- B. Color: As selected by Architect from manufacturer's full range.
- C. Pattern: As selected by Architect from manufacturer's full range, equal to Aragon #05164
- D. Fiber Content: 100-percent nylon 6, 6.
- E. Fiber Type: 100-percent branded nylon.
- F. Pile Characteristic: Textured loop pile.
- G. Dye Method: 85% Solution dyed / 15% Yarn dyed.
- H. Density Factor: Minimum 9,730 oz./cu. yd.
- I. Pile Height Average: Minimum 0.117-inches for finished carpet according to ASTM D 6859

- J. Stitches: Minimum 8.4 stitches per inch.
- K. Gage: Minimum 1/13.
- L. Face Weight: Minimum 20 oz./sq. yd.
- M. Total Weight: Minimum 70.0 oz./sq. yd. for finished carpet Primary Backing: 100-percent non-woven synthetic fiber.
- N. Secondary Backing: Non-RS (dry-back) non-permeable cushion backing.
- O. Roll Width: 6 feet.
- P. Applied Treatments:
 - 1. Applied Soil-Resistance Treatment: 100-percent branded soil protection.
 - 2. Antimicrobial Treatment: No antimicrobials added to product ASTM E2471-05.
- Q. Performance Characteristics:
 - 1. Texture Appearance Retention Rating (TARR): Heavy traffic, 3.0 minimum according to ASTM D 7330.
 - 2. Critical Radiant Flux Classification: Class 1, not less than 0.45 W/sq. cm according to NFPA 253.
 - 3. Smoke Density: Not more than 450 according to ASTM E 662.
 - 4. Dry Breaking Strength: Not less than 100 lbf according to ASTM D 2646.
 - 5. Tuft Bind: Not less than 10 lbf according to ASTM D 1335.
 - 6. Delamination: No delamination according to ASTM D 3936.
 - 7. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.
 - 8. Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) according to AATCC 16, Option E.
 - 9. Electrostatic Propensity: Less than 3.0 kV according to AATCC 134.
 - 10. Moisture penetration by impact at 10 psi: No penetration of backing and seam after 10,000 impacts.
 - 11. Static Coefficient of Friction: Minimum 0.60, passes ADA requirements for Accessible routes per ASTM C-1028.
 - 12. Compression Deflection: Minimum 7 lbs./sq. inch at 25%; Maximum 25 lbs./sq. inch at 25%.
 - 13. Recycled Content: Minimum 10 percent total recycled content.

2.3 WALK-OFF-MATS CPT-5

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Tandus; a Tarkett Company.
 - 2. Or equal.
- B. Color: As selected by Architect from manufacturer's full range.
- C. Pattern: Without high/low pile heights, equal to Tandus Abrasive Action II As selected by Architect from manufacturer's full range.
- D. Fiber Content: 100-percent nylon 6, 6.
- E. Fiber Type: 100-percent branded nylon.
- F. Pile Characteristic: Textured-loop pile.

- G. Dye Method: 100% solution dyed.
- H. Density Factor: Minimum 6,000 oz./cu. yd.
- I. Pile Height Average: Minimum 0.187-inches for finished carpet according to ASTM D 6859.
- J. Stitches: Minimum 8.0 stitches per inch.
- K. Gage: Minimum 1/12.
- L. Face Weight: Minimum 24 oz./sq. yd.
- M. Total Weight: Minimum 87 oz./sq. yd. for finished carpet.
- N. Primary Backing: 100-percent non-woven synthetic fiber.
- O. Secondary Backing: RS (peel & stick) non-permeable cushion backing.
- P. Size: 6 foot roll.
- Q. Applied Treatments:
 - 1. Applied Soil-Resistance Treatment: 100-percent branded soil protection.
 - 2. Antimicrobial Treatment: No antimicrobials added to product ASTM E2471-05.
- R. Performance Characteristics:
 - 1. Texture Appearance Retention Rating (TARR): Heavy traffic, 3.0 minimum according to ASTM D 7330.
 - 2. Critical Radiant Flux Classification: Class 1, not less than 0.45 W/sq. cm according to NFPA 253.
 - 3. Smoke Density: Not more than 450 according to ASTM E 662.
 - 4. Dry Breaking Strength: Not less than 100 lbf according to ASTM D 2646.
 - 5. Tuft Bind: Not less than 10 lbf according to ASTM D 1335.
 - 6. Delamination: No delamination according to ASTM D 3936.
 - 7. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.
 - 8. Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) according to AATCC 16, Option E.
 - 9. Electrostatic Propensity: Less than 3.0 kV according to AATCC 134.
 - 10. Moisture penetration by impact at 10 psi: No penetration of backing and seam after 10,000 impacts.
 - 11. Static Coefficient of Friction: Minimum 0.60, passes ADA requirements for Accessible routes per ASTM C-1028.
 - 12. Compression Deflection: Minimum 7 lbs./sq. inch at 25%; Maximum 25 lbs./sq. inch at 25%.
 - 13. Recycled Content: Minimum 10 percent total recycled content.

2.4 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet walk-off-mat manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet or walk-off-mat manufacturer for non-porous surfaces.
 - 1. VOC Content: Adhesives shall comply with the testing and product requirements of San Diego Air Pollution Control District Rule 67.0 Architectural Coatings• , and Rule 67.21 Adhesive Material Application Operations.•

- C. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.
- D. 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.
 - 1. Rubber Edge/Transition Strips: Extruded or molded heavy-duty rubber with minimum 2-inch Color: As selected by Architect from manufacturer's full range.

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 performance.
- B. Examine carpet for type, color, pattern, and potential defects.
- C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 03 30 00 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI's "CRI Carpet Installation Standard" and with carpet manufacturer's written installation instructions for preparing substrates.
- 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 with Concure Systems Crack Fill Binder compound.
- C. 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 sheet carpeting manufacturer. Do not use solvents.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.3 CARPET INSTALLATION

- A. Comply with CRI's "CRI Carpet Installation Standard" and carpet and/or walk-off-mat manufacturers' written installation instructions for the following:
 - 1. Direct-glue-down installation.
- B. Comply with carpet manufacturer's written instructions and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.
- C. Install pattern parallel to walls and borders.

- D. Install borders with mitered corner seams.
- E. Do not bridge building expansion joints with carpet.
- F. Cut and fit carpet 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 manufacturer.
- G. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- H. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet as marked on subfloor. Use nonpermanent, nonstaining marking device.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet:
 - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
 - 2. Remove yarns that protrude from carpet surface.
 - 3. Vacuum carpet using commercial machine with face-beater element.
- B. Protect installed carpet to comply with CRI's "CRI Carpet Installation Standard."
- C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods recommended in writing by carpet manufacturer.

END OF SECTION 096816

SECTION 097200 - WALL COVERINGS

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. Vinyl covered tackable wall panels.
 - 2. Vinyl wall covering writing surface

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include data on physical characteristics, durability, fade resistance, and flame-resistance characteristics.
- B. Shop Drawings: Show location and extent of each wall-covering type. Indicate pattern placement, seams and termination points.
- C. Samples for Initial Selection: For each type of wall covering indicated.
- D. Samples for Verification:
 - 1. Full width by 36-inch- long section of wall covering.
 - 2. Submit "mini-mural" of complete finished image printed on actual substrate specified.
 - 3. Submit sample section of final image at 100% resolution printed on actual substrate specified.
- E. Product Schedule: For wall coverings. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for wall covering with complete description of each wall covering, including pattern total weight fabric backing, tensile strength and fire hazard classification.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For wall coverings to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates according to test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Surface-Burning Characteristics: As follows, per ASTM E 84:
 - a. Flame-Spread Index: 10 or less.
 - b. Smoke-Density: 25 or less per ASTM E 84.
- B. Imperfections such as engraving roller die marks, roller repeat marks or other features deemed not in conformance with the specified materials, will be cause for rejection by the Architect, if evidenced in either the submitted samples, or the manufactured material.

- C. Tests: All test shall be performed in accordance with Federal Specification CCC-T-191b, except as follows:
 - 1. Adhesion of vinyl coating to the fabric backing shall be tested in accordance with ASTM S 751.
 - 2. Materials shall have a zone inhibition rating of "0" on face and "1" on backing to resist the growth of mildew and bacteria, as determined by test method ASTM G 21.
- D. Applicators Qualifications: Work of this section shall be performed by a firm regularly engaged in the installation of vinyl wallcoverings of the types and quantities specified, and acceptable to the Architect.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install wall coverings 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. Lighting: Do not install wall covering until a permanent level of lighting is provided on the surfaces to receive wall covering.
- C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

1.8 WARRANTY

- A. Manufacturer:
 - 1. Submit manufacturer's written five year warranty against manufacturing defects.
 - 2. Wallcovering exhibiting defects shall be replaced or repaired by the manufacturer. Secondary warranties involving those other than the manufacturer are not acceptable.
- B. Contractor:
 - 1. Provide guaranty, in Architect approved form, against installation defects for a period of 5 years after Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Low-Emitting Materials: Wall covering system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 VINYL WALL COVERING WRITING SURFACE (VWC-1)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Koroseal.
 - b. Whiteboards etc.
 - c. Tri-kes.
 - d. Or Equal.
- B. Type: Equal to Walltalker Project-Write
- C. Construction:

1. Grade: Type II, medium duty, Type Class A per FS CCC W 408A.
2. Total Weight: 18.0 oz/PSY
3. Fabric Weight: 1.8 oz/PSY
4. Vinyl Weight: 12oz/PSY
5. Laminate Thickness: 17 mils
6. Fabric: Non-Woven
7. Surface gloss: Matte.
8. Width: 60 inches.
9. Color: White.
10. Top Trim: Extruded aluminum per manufacturer.
11. Bottom Trim: Marker tray per manufacturer.

2.3 VINYL COVERED TACKABLE WALL PANELS (VCTWP)

A. VINYL WALL COVERING

1. Manufacturer: Koroseal-Vicrtex or equal.
2. Type: Lino, Vinyl Coated Fabric.
3. Construction:
 - a. Grade: Type II, medium duty, Type Class A per FS CCC W 408A.
 - b. Total Weight: 12 oz/PLY
 - c. Vinyl Weight: 14.0 oz/PSY
 - d. Backing: Osnaburg.
4. Color: As selected by Architect.

B. FIBERBOARD PANEL

1. Manufacturer: Lamvin, Inc or equal.
2. Panel Core: Compressed industrial insulation wood fiberboard per ASTM C208.
 - a. Construction:
 - 1) Size: 1/2 inch thickness, 4 foot wide by full wall height plus 6 inches above lay in ceilings or as shown on drawings. No horizontal joints permitted in classroom applications, except at locations shown on drawings.
 - 2) Edge: Square edge.
 - 3) Finish: Factory finish appropriate for vinyl wall covering.
 - b. Characteristics
 - 1) Density: 16 pounds per cubic foot
 - 2) Modulus of Rupture: 360 PSI.
 - c. Fire/Habitability Criteria
 - 1) Flame Spread Index: 76-200 Class C per CBC Chapter 8.
 - 2) Smoke Developed: Maximum 450 per ATM E-84.
 - d. Recycled Content: Minimum 100 percent total recycled content, with minimum 100 percent post-consumer recycled content.

C. VINYL PLASTIC EDGE

1. Provide vinyl plastic edge, factory prefinished with specified vinyl wallcovering, sized to match panel thickness, with 1/4 to 1/2 inch visible return leg dimension at door and window openings.

2.4 ACCESSORIES

- A. Adhesive: Mildew-resistant, nonstaining, strippable adhesive, for use with specific wall covering and substrate application; as recommended in writing by wall-covering manufacturer.

1. Adhesive shall have VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Primer/Sealer for VWC: Mildew resistant, complying with requirements in Section 09 91 23 "Interior Painting" Section and recommended in writing by wall-covering manufacturer for intended substrate.
- C. Wall Liner: Nonwoven, synthetic underlayment and adhesive as recommended by wall-covering manufacturer.
- D. Seam Tape: As recommended in writing by wall-covering manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for levelness, wall plumbness, maximum moisture content, and other conditions affecting performance of the Work.
- B. 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 that could impair bond of wall covering, including dirt, oil, grease, mold, mildew, and incompatible primers.
- C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.
1. Gypsum Board: Prime with primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
- D. Check painted surfaces for pigment bleeding. Sand gloss, semigloss, and eggshell finish with fine sandpaper.
- E. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.
- F. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.
- G. Install wall liner, with no gaps or overlaps, where required by wall-covering manufacturer. Form smooth wrinkle-free surface for finished installation. Do not begin wall-covering installation until wall liner has dried.

3.3 VINYL WALL COVERING INSTALLATION

- A. General: Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated except where more stringent requirements apply.
- B. Cut wall-covering strips in roll number sequence. Change roll numbers at partition breaks and corners.

- C. Install strips in same order as cut from roll.
- D. Install reversing every other strip.
- E. Install wall covering with no gaps or overlaps, no lifted or curling edges, and no visible shrinkage.
- F. Vertical seams are not acceptable.
- G. Horizontal seams are not acceptable between three and seven feet above finish floor.
- H. Match pattern 72 inches above the finish floor.
- I. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.
- J. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without any overlay or spacing between strips.

3.4 VINYL WALL COVERING FIBERBOARD PANEL INSTALLATION

- A. Install fiberboard panels prior to installation of markerboards, cabinets and counters, unless shown otherwise.
- B. Install vinyl covered fiberboard on walls scheduled to have tackable surface and terminate at lay in ceiling.
 - 1. Pre-fabricated Panel Installation.
 - a. Apply vinyl wall covering around fiberboard panel edges and glue to back of panel, using applicable vinyl wallcovering installation criteria specified in this Section.
 - b. Apply adhesive to gypsum board substrate to assure full contact with tackboard panel.
 - c. Apply tackable fiberboard panel over gypsum board before adhesive takes set. Press into place to assure full panel contact without delamination. Space panels 1/16 inch apart.
 - d. Apply tackable fiberboard panel over gypsum board in full width panels, extending from floor to height shown on drawings. Center vertical joints in wall surface, unless otherwise shown.

3.5 CLEANING

- A. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.
- B. Use cleaning methods recommended in writing by wall-covering manufacturer.
- C. Replace strips that cannot be cleaned.
- D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 097200

SECTION 099113 - EXTERIOR PAINTING

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 surface preparation and the application of paint systems on **the** following exterior substrates:
 - 1. Steel.
 - 2. Galvanized metal.
 - 3. Exterior portland cement plaster (stucco).
 - 4. Concrete
 - 5. Fiber cement siding and soffit panels.

1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- E. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. 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.
- D. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 3. VOC content.

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. Paint: 1 gal. of each material and color applied.

1.6 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 Surfaces: Provide samples of at least 25 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.

1.7 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.

1.8 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 snow, 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. Manufacturers: Subject to compliance with requirements, provide products by the following or equal:
 - 1. Dunn-Edwards Corporation.
 - 2. Sherwin-Williams Company (The).
 - 3. Vista Paint.

2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. 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.
- C. VOC Content: Provide materials that comply with VOC limits of South Coast Air Quality Management District (SCAQMD) Rule 1168 and authorities having jurisdiction.
- D. Colors: As selected by Architect from manufacturer's full range.
- E. Products:
1. Steel Doors and Frames / Flashings / Exposed Metal Galvanized Decking - Galvanized (PFX-1)
 - a. Etch with GLL Clean and Etch and rinse with clear water.
 - b. One coat primer SW ProCryl Acrylic Metal Primer.
 - c. Two coats finish SW ProIndustrial Acrylic Semigloss.
 2. Ferrous Metal Piping / Trusses / Steel Members / Miscellaneous Metal Fabrications, and Related Components, – galvanized and non-galvanized- (PFX-2).
 - a. Solvent clean per SSPC-SP1 and prime as required.
 - b. Base coat V69F Epoxiline or Sherwin-Williams Macropoxy 646 Fast Cure, B58 Series.
 - c. Two coats Tnemec Series 1029 Enduratone Acrylic Polymer at 2-3 mils DFT or Sherwin-Williams ProIndustrialAcrylic Semigloss, B66-650 at 3-4 mils DFT.
 3. Plaster, Cast-in-place Concrete Wall Surfaces, Fiber Cement Siding and Soffit Panels - Flat - (PFX-3).
 - a. One coat SW Loxon Masonry Primer.
 - b. Two coats SW A-100 Acrylic Flat.
 4. Concrete masonry units (CMU) - Flat- (PFX-4).
 - a. Clean surfaces. Repair cracks and loose mortar.
 - b. Filler: SW Preprite Acrylic Block Filler.
 - c. Two coats SW A-100 Acrylic Flat.

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. Portland Cement Plaster: 12 percent.
 2. Concrete: 12 percent.
 3. Wood: 15 percent.
 4. Gypsum Board: 12 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. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.
 - 1. Bare Steel: Sand and scrape to remove loose primer and rust. Clean surfaces with solvent.
- E. 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.
- F. Galvanized-Metal Substrates: Prepare bare, untreated galvanized steel metal surfaces in accordance with manufacturer's instructions and comply with SSPC-SP1.
 - 1. Before surface preparation and coating application, the coating applicator should verify that the galvanized and galvanized steel did not receive a passivation treatment. Once this has been determined, either of the following procedure may be used for non-immersion service.
 - 2. Procedure Abrasive Blasting Method:
 - a. Remove all soluble and insoluble contaminants and corrosion. Remove any storage stains per section 6.2 of ASTM D6386.
 - b. Thoroughly roughen the entire surface to be coated using compressed air brush off blast cleaning per ASTM D 6386 to achieve a uniform anchor profile (1.0 - 2.0 mils). When this method is used, system DFT shall not exceed 7 mils.
 - 3. Steel Doors and Door/Window Frames:
 - a. Provide specified primer at all frames, including frames with fabricators primer system. Comply with criteria specified in this Section.
 - b. Prepare frame steel surfaces as required for proper adhesion and appearance of specified finish coat system.
 - c. Paint all surfaces of window frames, including surfaces not visible when operable vent portions are in closed position.
- G. Plaster Surfaces: Repair minor defects, including cracks, in an approved manner. Remove plaster nibs and other protrusions.

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. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat. Obtain Owners Representative approval of each coat prior to applying succeeding coat.
- C. Allow applied coat to dry before next coat is applied.
- D. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- E. 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.
- F. Steel Doors: Finish all surfaces of doors, including tops and bottoms.
1. Apply paint to non-factory prefinished doors and frames by spray method only.
- G. Exterior surfaces, including plaster, concrete, metal fabrications, structural components and metal flashings: Unless noted otherwise, apply paints and coatings as specified below:
1. Do not paint exterior galvanized metals, including railings, steel structural components and all roof flashings and accessories.
 2. Apply exterior paint PFX-3 to all plaster surfaces, plaster trim, reveals and accessories.
 3. Apply exterior paint PFX-3 to exposed concrete footing and foundation surfaces as directed by Architect.
 4. Unless specified as prefinished, apply exterior paint PFX-1 to metal roof copings, gutters, downspouts and flashings visible to the eye from typically occupied locations.
- H. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
1. Paint the following work where exposed to view:
 - a. Equipment, including panelboards **and switch gear**.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.

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.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

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 surface preparation and the application of paint systems on the following interior substrates:
 - 1. Concrete.
 - 2. Steel.
 - 3. Cast iron.
 - 4. Galvanized metal.
 - 5. Aluminum (not anodized or otherwise coated).
 - 6. Wood.
 - 7. Gypsum board.
 - 8. Plaster.
- B. Related Requirements:
 - 1. Section 051200 "Structural Steel Framing" for shop priming of metal substrates with primers specified in this Section.
 - 2. Section 099113 "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.
 - 3. .

1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. 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.
- D. Product List: For each product indicated, include the following:
1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
 3. VOC content.

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. Paint: **5** percent, but not less than 1 gal. of each material and color applied.

1.6 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.

1.7 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.

1.8 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

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, **provide products by one of the following:**
- 1.
 2. Dunn-Edwards Corporation.
 3. Sherwin-Williams Company (The).
 4. Vista Paint.
 5. Or equal.

2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. 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.
- C. Colors: **As selected by Architect from manufacturer's full range.**
- D. Products: For ease of specifying, unless otherwise noted, product numbers of Sherwin Williams have been used.
1. Steel Doors and Frames/Miscellaneous metal- Galvanized - Semi-Gloss (PF-1)
 - a. Solvent clean, etch with PCI 02150 Metal Conditioner solution and rinse with clear water.
 - b. One coat primer SW ProCryl Acrylic Metal Primer.
 - c. Two Coats Finish SW ProIndustrial Acrylic Semigloss.
 - d.
 - e.
 2. Ferrous metal piping, miscellaneous metal fabrications, and related components. (PF-2)
 - a. Solvent clean and rinse with clear water.
 - b. One coat primer SW ProCryl Acrylic Metal Primer.
 - c. Two Coats Finish SW ProIndustrial Acrylic Semigloss.
 - d.
 - e.
 3. Gypsum Board - Low Sheen/Eggshell Paint Finish (PF-3)
 - a. One coat SW Quick Dry Interior/ Exterior Latex Primer.
 - b. Two coats SW ProMar 200 Zero VOC Eg-shel
 - c.
 - d.
 4. Gypsum Board - Semi-Gloss Enamel finish (PF-4)
 - a. One coat SW Quick Dry Interior/ Exterior Latex Primer.
 - b. Two coats SW ProMar 200 Zero VOC Semigloss.
 - c.
 - d.
 5. Masonry: Eggshell finish – (PF-5).
 - a. One coat: SW Preprite Block Filler.

- b. Two coats: SW ProMar 200 Zero VOC Eg-shel.
 - c.
 - d.
- 6. Masonry: Semigloss finish – (PF-6)
 - a. Clean the surfaces. Repair cracks and loose mortar.
 - b. One coat Tnemec 1254 Epoxoblock WB Filler or Sherwin-Williams Heavy Duty Block Filler, B42W00150.
 - c. Two coats Tnemec Series 1029 Enduratone Acrylic Polymer at 2-3 mils DFT or Sherwin-Williams ProIndustrial Acrylic Semigloss at 3-4 mils DFT.
- 7.
- 8.
- 9. Wood Theater Floor: Flat Finish – (PF-7)
 - a. One coat recommended primer SW Preprite ProBlock Primer.
 - b. Two coats SW ProMar 400 Flat Black.
 - c.
 - d.
- 10. Gypsum Board Primer - Behind Vinyl Wall Covering & Walltalker
 - a. One coat SW Quick Dry Interior/ Exterior Latex Primer and as recommended in writing by wall-covering manufacturer for intended substrate.

2.3 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 - 1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint 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 paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints 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. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Wood: 15 percent.
 - 3. Gypsum Board: 12 percent.
 - 4. Plaster: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Plaster Substrates: Verify that plaster is fully cured.

- E. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.
- F. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- G. 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. 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. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 - 1. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."
- G. 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.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Aluminum Substrates: Remove loose surface oxidation.
- J. 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.
- K. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

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. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. 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.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed in equipment rooms:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.
 - h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - i. Electrical equipment that is indicated to have a factory-primed finish for field painting.
 - 2. 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.
 - 3. 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.

END OF SECTION 099123

SECTION 099724 - CONCRETE SLAB MOISTURE CONTROL COATING

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 fluid-applied, resin-based, membrane-forming systems that control the moisture-vapor-emission rate of high-moisture, interior concrete to prepare it for floor covering installation.
- B. Before installation of flooring finishes over interior concrete slabs, District will have concrete floor slab moisture content tests performed by an independent laboratory to determine the level of vapor emissions in the concrete slabs, the pH level, and the amount of and location where moisture vapor emission control system will be applied. District will provide copies of the test results to the Architect, Project Inspector, and Contractor prior to the installation of the flooring finishes. If remedial action is indicated, it shall be performed by the Contractor in accordance with this section prior to the installation of the flooring finishes. This testing will occur before and after the moisture vapor emission control system is installed.

1.3 PRE-INSTALLATION MEETINGS

- A. Pre-installation Conference: Conduct conference at Project site.

1.4 DEFINITIONS

- A. MVE: Moisture vapor emission.
- B. MVER: Moisture vapor emission rate.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product and system specified, including:
 - 1. Manufacturer's Specification.
 - 2. Manufacturer's Material Safety Data Sheets for moisture vapor emission control system proposed for use.
 - 3. Installation Instructions.
 - 4. Certification Requirements.
 - 5. Warranty Information.
 - 6. List of product use and performance history, for the same formulation and system design, listing reference sources. Similar projects shall have documented minimum initial vapor emission rates of 25 lbs per 1,000 sf per 24 hrs / 100% RH, and have resulted in maintained vapor reduction rate of less than 3 lbs per 1,000 sf per 24 hrs / 75% RH when tested in accordance with ASTM F 1869 and ASTM F 2170.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installer and manufacturer.
 - 1. Installer Qualifications: Employ an installer currently certified by the Manufacturer, experienced in surface preparation and application of material, and subject to the inspection and control of the Manufacturer.
 - 2. Manufacturer Qualifications:

- a. Minimum five (5) years of manufacturing the same moisture vapor emission control products without change of formulation or system design.
- b. Manufacturer shall have independent lab test reports documenting performance per the following:
 - 1) ASTM E 96, Water Vapor Transmission (wet methods). Performance shall be documented by an independent testing laboratory at a minimum of 96% for vapor emission control compared to untreated ACI Committee 201 durable concrete.
 - 2) ASTM E 96 Permeance Rating: Product cannot exceed a 0.1 permeance rating.
 - 3) ASTM F 3010: Two-component resin based membrane-forming mitigation system for use under resilient floor coverings. Conform to properties, application and performance of standard.
 - 4) ASTM D 7234: Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers.
 - 5) ASTM D 1308; Insensitivity to alkaline environment up to pH 14.
 - 6) Certify acceptance and exposure to continuous topical exposure after final cure.
 - 7) Reduce Calcium Chloride readings up to 25-lbs/1000 sq. ft. / 24 hrs. in one coat and perform as required with RH Probe readings of 100%.

B. Sample Warranty: For manufacturer's warranty.

C. Product Test Reports: For each MVE-control system.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating directions for storage and mixing with other components.
- B. Store products in ventilated, dry spaces protected from the weather, with ambient temperatures maintained between 50 and 90 deg. F. Protect from dampness, freezing, and direct sunlight.
- C. Handle product in a manner that shall prevent breakage of containers and damage to products.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Comply with MVE-control system manufacturer's written instructions for substrate and ambient temperatures, humidity, ventilation, and other conditions affecting system installation.
 1. Store system components in a temperature-controlled environment and protected from weather and at ambient temperature of not less than 65 deg. F and not more than 85 deg. F at least 48 hours before use.
 2. Maintain ambient temperature and relative humidity in installation areas within range recommended in writing by MVE-control system manufacturer, but not less than 65 deg. F for more than 85 deg. F and not less than 40 or more than 60 percent relative humidity, for 48 hours before installation, during installation, and for 48 hours after installation unless longer period is recommended in writing by manufacturer.
 3. Install MVE-control systems where concrete surface temperatures will remain a minimum of 5 deg. F higher than the dew point for ambient temperature and relative humidity conditions in installation areas for 48 hours before installation, during installation, and for 48 hours after installation unless longer period is recommended in writing by manufacturer.

4. Do not apply products to unprotected surfaces in wet weather or to substrates on which ice, frost, or water is visible.
 5. Products cannot be applied when Dew Point conditions exist. Consult the Manufacturer for specific guidelines concerning this condition.
 6. Allow continuous ventilation and indirect air movement at all times during application and curing process of the moisture vapor emission control systems.
- B. Protection: Protect products to prevent damage from active rain or topical water for a minimum period of 24 hours from time of application.
- 1.9 SCHEDULING
- A. Coordinate scheduling of testing and allow enough time for the testing, the installation of the moisture vapor emission control system, and the re-testing before installation of floor finishes.
- B. Allow the concrete slab to cure for not less than 28 days before testing. Consult with the District Construction Manager if an accelerated timetable is necessary.
- 1.10 WARRANTY
- A. General Warranty: The warranties specified in this Article shall not deprive the District of other rights the District may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Standard Manufacturer's Warranty: Submit Manufacturer's standard written warranty, signed by moisture vapor emission control systems Manufacturer agreeing to promptly repair defects in materials or workmanship for the following warranty period:
1. Standard Manufacturer's Warranty: Manufacturer shall provide the District with its standard ten (10) year warranty at no additional cost.
 2. Installer's Warranty: Installer of moisture vapor emission control systems shall provide standard installation warranty for workmanship.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. MVE-Control System Capabilities: Capable of suppressing MVE without failure where installed on concrete that exhibits the following conditions:
1. MVER: Maximum 25 lb of moisture vapor emission /1000 sq. ft. when tested according to ASTM F 1869.
 2. Relative Humidity: Maximum 100 percent when tested according to ASTM F 2170 using in situ probes.
- B. Water-Vapor Emission: Through MVE-control system, maximum 0.10 perm when tested according to ASTM E 96/E 96M.
- C. Tensile Bond Strength: For MVE-control system, greater than 1,000 psi at 28 days with failure in the concrete according to ASTM D 7234.

2.2 MVE-CONTROL SYSTEM

- A. Manufacturers: Subject to compliance with requirements, provide one of the following products:
1. Allied Construction Technologies, Inc.; AC Tech 2170 Vapor Reduction Systems.

2. KOSTER American Corporation. Koster; VAP 1 2000 System.
 3. MAPEI Corporation; Planiseal MVR.
 4. Or equal.
- B. MVE-Control System: ASTM F 3010-qualified, fluid-applied, two-component, epoxy-resin, membrane-forming system; formulated for application on concrete substrates to reduce MVER to level required for installation of floor coverings indicated and acceptable to manufacturers of floor covering products indicated, including adhesives.
1. ASTM E 96, Water Vapor Transmission (dry and wet methods) Performance shall be documented by an independent testing laboratory at a minimum 96% vapor emission reduction compared to untreated ACI Committee 201 durable concrete.
 2. ASTM D 1308; Insensitivity to alkaline environment up to pH 14.
 3. Long-term adhesion ASTM D 7234 Adhesion Properties after ASTM E 96 when applied onto damp, fresh, or old concrete with constant vapor emission.
 4. Substrate Primer: Provide MVE-control system manufacturer's concrete-substrate primer if required for system indicated by substrate conditions.
 5. Cementitious Underlayment Primer: If required for subsequent installation of cementitious underlayment products, provide MVE-control system manufacturer's primer to ensure adhesion of products to MVE-control system.
 6. This system shall be applied to a properly prepared concrete surface. Testing showing a pH in excess of 10 and / or vapor emission levels as indicated in specified finish flooring Sections shall determine where this system is used and the coverage rates required. The moisture vapor emission control system shall reduce vapor emissions by a minimum of 96% after final cure.

2.3 ACCESSORIES

- A. Patching and Leveling Material: Moisture-, mildew-, and alkali-resistant product recommended in writing by MVE-control system manufacturer and with minimum of 4000-psi compressive strength after 28 days when tested according to ASTM C 109.
- B. Crack-Filling Material: Resin-based material recommended in writing by MVE-control system manufacturer for sealing concrete substrate crack repair.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of the Work.
- B. Adhesion tests:
 1. Verify for acceptability the proper adhesion of flooring adhesives, coatings, and leveling compounds to the final moisture vapor emission control coating system. Contact moisture vapor emission control system Manufacturer's representative for recommendations.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
 1. Installation of system indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Clean all surfaces to receive moisture vapor emission control system. Shot blast all floors and clean surfaces with Shop Vac to remove all residue from the substrate. Remove all defective materials and foreign matter such as dust, adhesives, leveling compounds, paint, dirt, floor hardeners, bond breakers, oil, grease, curing agents, form release agents, efflorescence, laitance, shot blast BBs, etc. Inform moisture vapor emission control system manufacturer if concrete additives like chlorides or other soluble compounds that can contaminate surfaces have been used in the concrete mix. Reinforcing fibers shall be burned off, scraped, and vacuumed. Acid etching is not allowed.
- B. Prior to moisture vapor emission control system installation, repair concrete including all cracks, expansion joints, control joints, and open surface honeycombs in accordance with moisture vapor emission control systems Manufacturer's recommendations.
- C. Verify that surfaces to be treated with moisture vapor emission control systems have not previously been treated with other materials such as underlayments, screeds, penetrating sealants, etc. If this is the case, consult with the Manufacturer's representative prior to application of moisture vapor emission control systems.
- D. Only a surface substrate that remains uncontaminated and sound is fit to receive a moisture vapor emission control system. Comply with all requirements as listed in Manufacturer's technical data information.
- E. Proper removal of contaminants can render surfaces too rough for certain flooring systems. Shot blast a small test area and verify with the flooring applicator that the surfaces are fit to receive the specified flooring system without the application of an underlayment on top of the moisture vapor emission control system.
- F. Use clean containers and mix thoroughly as per Manufacturer's requirements to obtain a homogeneous mixture. Use a low speed motor less than 400 rpm and a two bladed Jiffy mixing blade only. Do not aerate. Mix ratios are measured by volume.

3.3 DISTRICT TESTING

- A. Before installation of flooring finishes over interior concrete slabs, District will have concrete floor slab moisture content tests performed by an independent laboratory to determine the level of vapor emission in the concrete slabs, the pH level and the amount of and location where moisture vapor emission control system will be applied. If remedial action is indicated, perform such action in accordance with this section prior to the installation of the flooring finishes.
- B. After installation of the moisture vapor emission control system the District will repeat the testing procedure to confirm that the vapor emission and pH levels are adequate to receive the flooring finishes.

3.4 APPLICATION

- A. General: Install MVE-control system according to ASTM F 3010 and manufacturer's written instructions to produce a uniform, monolithic surface free of surface deficiencies such as pin holes, fish eyes, and voids.
 - 1. Install primers as required to comply with manufacturer's written instructions.
- B. Vapor Emission Level Reduction System:

1. Coverage by this system will be affected by the surface texture and porosity of the substrate as well as the measured level of moisture.
 2. Provide coverages relative to moisture vapor emissions as follows:
 - a. Spread moisture vapor emission control coating onto ICRI CSP-3 shot-blasted and prepared concrete surface at a rate of no greater than 130 sq. ft./gal. in one coat. Concrete prepared to CSP-3 coated at 130 sq. ft./gal. will yield an average dry mil thickness of no less than 12 mils (0.012 in.). Moisture vapor emission control coatings must be installed at a minimum dry mil thickness of no less than 12 mils (0.012) as less dry mil thickness will result in a higher permeance of the cured coating that will not meet the performance requirements of ASTM-F 3010 and Article 2.1 of this Specification.
 3. Apply moisture vapor emission control system in accordance with manufacturer's recommendations. Re-test after system has cured and before installing flooring finishes. Refer to additional application instructions in the Manufacturer's technical data sheets.
- C. Level and smooth surfaces as required by flooring manufacturer after shot blasting, surface preparation, and cured installation of the moisture vapor emission control system. Use an underlayment system manufactured, tested, and/or approved by the moisture vapor emission control system Manufacturer prior to installation. No underlayment system containing gypsum will be allowed. When water based adhesives are utilized in the floor covering installation, use previously approved underlayment systems with primer that is applied directly to the moisture vapor emission control system prior to the installation of the flooring system. Coordinate with the adhesive manufacturer for its minimum recommended thickness of cementitious underlayment to absorb excess moisture in the adhesive.
- D. Do not apply MVE-control system across substrate expansion, isolation, and other moving joints.
- E. Apply system, including component coats if any, in thickness recommended in writing by MVE-control system manufacturer for MVER indicated by preinstallation testing.
- F. Cure MVE-control system components according to manufacturer's written instructions. Prevent contamination or other damage during installation and curing processes.
- G. After curing, examine MVE-control system for surface deficiencies. Repair surface deficiencies according to manufacturer's written instructions.
- 3.5 CLEANING AND PROTECTION
- A. Protect MVE-control system from damage, wear, dirt, dust, and other contaminants before floor covering installation. Use protective methods and materials, including temporary coverings, recommended in writing by MVE-control system manufacturer.
- B. Do not allow subsequent preinstallation examination and testing for floor covering installation to damage, puncture, or otherwise compromise the MVE-control system membrane.
- C. Clean all tools and equipment with xylene (or other cleaning agent as recommended by the manufacturer) immediately after use when applying the moisture vapor emission control level reduction system.
- D. Remove from the Project site all debris resulting from moisture vapor emission control system installation.
- E. Protect each coat during specified cure period from all traffic, water, and contaminants.

END OF SECTION 099724

SECTION 101100 - VISUAL DISPLAY SURFACES

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. Visual display board assemblies, including markerboards and tackboards.
 - 2. Sliding visual display units.

1.3 PRE-INSTALLATION MEETINGS

- A. Pre-installation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units.
- B. Shop Drawings: For visual display units.
 - 1. Include plans, elevations, sections, details, and attachment to other work.
 - 2. Show locations of panel joints. Show locations of field-assembled joints for factory-fabricated units too large to ship in one piece.
 - 3. Include sections of typical trim members.
- C. Samples for Initial Selection: For each type of visual display unit indicated, for units with factory-applied color finishes, and as follows:
 - 1. Samples of facings for each visual display panel type, indicating color and texture. Provide all colors and textures available from the manufacturer for selection by the Architect.
 - 2. Fabric swatches of fabric facings for tackboards. Provide all colors and textures available from the manufacturer for selection by the Architect.
 - 3. Actual factory-finish color samples, applied to aluminum substrate.
 - 4. Include accessory Samples to verify color selected.
- D. Samples for Verification: 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 for final Work. Include one panel for each type, color, and texture required.
 - 2. Trim: 6-inch-long sections of each trim profile.
 - 3. Display Rail: 6-inch-long section of each type.
 - 4. Accessories: Full-size Sample of each type of accessory.
- E. Product Schedule: For visual display units.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface-burning characteristics of tackboards.

- C. Sample Warranties: For special warranties.
- 1.6 CLOSEOUT SUBMITTALS
 - A. Maintenance Data: For visual display units to include in maintenance manuals.
- 1.7 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.
- 1.8 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.
- 1.9 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:
 - a. Markerboards: Life of the building.
 - b. Tackboards: 5 yrs. 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: 450 or less.
- 2.3 VISUAL DISPLAY BOARD ASSEMBLY
 - A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. A-1 Visual Systems.
 - 2. Claridge Products and Equipment, Inc.

3. Platinum Visual Systems.
 4. Or Equal.
- B. Visual Display Board Assembly: Factory fabricated to the greatest extent possible.
1. Assembly: Markerboard and tackboard.
 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. Tackboard Panel: Vinyl-fabric-faced tackboard panel on core indicated.
1. Fabric Wrapped Edge: Wrap edge of tackboard panel with fabric facing.
 2. Color and Pattern: As selected by Architect from full range of industry colors.
- E. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch-thick, extruded aluminum; standard size and shape
1. Field-Applied Trim: Manufacturer's standard, snap-on trim with no visible screws or exposed joints.
 2. Aluminum Finish: Clear anodic finish.
- F. Joints: Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.
- G. Combination Assemblies: Provide manufacturer's standard exposed trim between abutting sections of visual display panels.
- H. Chalktray: Manufacturer's standard; continuous.
1. Box Type: Extruded aluminum with slanted front, grooved tray, and cast-aluminum end closures.
 2. Solid Type: Extruded aluminum with ribbed section and smoothly curved exposed ends.
- I. Display Rail: Manufacturer's standard, extruded-aluminum display rail with plastic-impregnated-cork insert, end stops, and continuous paper holder, designed to hold accessories.
1. Size: 1 inchhigh by full length of visual display unit.
 2. Map Hooks: Two map hooks for every 48 inches of display rail or fraction thereof.
 3. Map Hooks and Clips: Two map hooks with flexible metal clips for every 48 inches of display rail or fraction thereof.
 4. Flag Holder: One for each room.
 5. Tackboard Insert Color: As selected by Architect from full range of industry colors.

2.4 TACKBOARD PANELS

- A. Tackboard Panels:
1. Facing: Vinyl fabric factory laminated to 1/4-inch-thick cork sheet.
 2. Core: Manufacturer's standard 1/4-inch-thick manufacturer's standard backing.

2.5 MATERIALS

- A. Porcelain-Enamel Face Sheet: PEI-1002, with face sheet manufacturer's standard two- or three-coat process.

- B. Natural-Cork Sheet: Seamless, single-layer, compressed fine-grain cork sheet; bulletin board quality; face sanded for natural finish with surface-burning characteristics indicated.
- C. Vinyl Fabric: Mildew resistant, washable, complying with FS CCC-W-408D, Type II, weighing not less than 13 oz./sq. yd.; laminated to 1/4-inch- thick cork sheet, with surface-burning characteristics indicated in Performance Requirements.
- D. Hardboard: ANSI A135.4, tempered.
- E. Fiberboard: ASTM C 208.
- F. Particleboard: ANSI A208.1, Grade M-1.
- G. Hardwood Plywood: HPVA HP-1.
- H. Extruded Aluminum: ASTM B 221, Alloy 6063.
- I. 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. Adhesive shall comply with the testing and product requirements of San Diego Air Pollution Control District Rule 67.0 "Architectural Coatings" and Rule 67.21 "Adhesive Material Application Operations."
- J. Primer/Sealer: Mildew-resistant primer/sealer complying with requirements in Section 09 91 23 "Interior Painting" and recommended in writing by visual display unit manufacturer for intended substrate.

2.6 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.

2.7 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. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. 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.
- D. Prime wall surfaces indicated to receive visual display units and as recommended in writing by primer/sealer manufacturer and visual display unit manufacturer.
- E. Prepare recesses for sliding visual display units as required by type and size of unit.

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, trim, and accessories necessary for complete installation.
- B. Field-Assembled Visual Display Board Assemblies: Coordinate field-assembled units with grounds, trim, and accessories indicated. Join parts with a neat, precision fit.
 - 1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.
 - 2. Where size of visual display board assemblies or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.
- C. Factory-Fabricated Visual Display Board Assemblies: Adhere to wall surfaces with egg-size adhesive gobs at 16 inches o.c., horizontally and vertically.
- D. Factory-Fabricated Visual Display Board Assemblies: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display board assemblies with fasteners at not more than 16 inches o.c. Secure tops and bottoms of boards to walls.
- E. Visual Display Board Assembly Mounting Heights: Install visual display units at mounting heights indicated on Drawings, or if not indicated, at heights indicated below.
 - 1. Mounting Height for Grades K through 3: 24 inches above finished floor to top of chalktray.
 - 2. Mounting Height for Grades 4 through 6: 28 inches above finished floor to top of chalktray.
 - 3. Mounting Height for Grades 7 and Higher: 36 inches above finished floor to top of chalktray.
- F. Sliding Visual Display Units: Install units at mounting heights indicated. Attach to wall framing with fasteners at not more than 16 inches o.c.
 - 1. Adjust panels to operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

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 101419 - DIMENSIONAL LETTER SIGNAGE

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. Cast dimensional characters.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For dimensional letter 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, and layout for each sign.
- C. Samples: 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. Dimensional Characters: Full-size Sample of dimensional character.
- D. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

1.4 CLOSEOUT SUBMITTALS

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

1.5 FIELD CONDITIONS

- A. Field Measurements: Verify locations of electrical service embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.6 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. Separation or delamination of sheet materials and components.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 DIMENSIONAL CHARACTERS

- A. Cast Dimensional Characters: Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:

1. Manufacturers: Subject to compliance with requirements, provide products by the following or equal:
 - a. A. R. K. Ramos Signage Systems.
 - b. Gemini, Inc.
 - c. Or equal.
2. Character Material: Cast aluminum.
3. Character Height: 8 inches.
4. Thickness: Manufacturer's standard for size of character.
5. Finishes:
 - a. Integral Aluminum Finish: Anodized color as selected by Architect from full range of industry colors and color densities.
6. Mounting: Concealed studs Projecting studs.
7. Typeface: Kabel.

2.2 DIMENSIONAL CHARACTER MATERIALS

- A. Aluminum Castings: ASTM B 26/B 26M, alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.
- B. 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.

2.3 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. Exposed Metal-Fastener Components, General:
 - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
 4. Sign Mounting Fasteners:
 - a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
 - b. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
- B. Adhesives: As recommended by sign manufacturer and with a VOC content of 70 g/L or less for adhesives used inside the weatherproofing system and applied on-site when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Adhesives: As recommended by sign manufacturer and that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

2.4 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 - 1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
 - 2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
 - 3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
 - 4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
 - 5. Internally brace signs for stability and for securing fasteners.
 - 6. 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.
 - 7. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

2.5 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.
- C. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.6 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

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 electrical service is correctly sized and located to accommodate signs.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATIONC

- 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. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
 - 3. 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.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters 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 101419

SECTION 101423 - PANEL SIGNAGE

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. Room-identification signs.
 - 2. Directional and Informational Signage, site, exterior and interior.
 - 3. Safety signage.
 - 4. Vehicle traffic control signage.
 - 5. Exterior dedication plaque.
 - 6. Exterior Marquee display.

1.3 DEFINITIONS

- A. Accessible: In accordance with the accessibility standard.

1.4 REGULATORY REQUIREMENTS

- A. Signage and graphics:
 - 1. Raised characters shall comply with CBC Section 11B-703.2:
 - a. Depth: It shall be 1/32 inch (0.8 mm) minimum above their background and shall be sans serif uppercase and be duplicated in Braille.
 - b. Height: It shall be 5/8 inch (15.9 mm) minimum and 2 inches (51 mm) maximum based on the height of the uppercase letter "I". CBC Section 11B-703.2.5 .
 - c. Finish and contrast: Characters and their background shall have a non-glare finish.
 - d. 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.
 - e. Proportions: It shall be selected from fonts where the width of the uppercase letter "O" is 60 % minimum and 110 % maximum of the height of the uppercase letter "I". Stroke thickness of the uppercase letter "I" shall be 15 % maximum of the height of the character. CBC Sections 11B-703.4 and 11B-703.6.
 - f. Character Spacing: Spacing between individual tactile characters shall comply with CBC Section 11B-703.2.7 and 11B-703.2.8.
 - g. Format: Text shall be in a horizontal format. CBC Section 11B-703.2.9.
 - h. Braille: It shall be contracted (Grade 2) and shall comply with CBC Sections 11B-703.3 and 11B-703.4. Braille dots shall have a domed or rounded shape and shall comply with CBC Table and Figure 11B-703.3.1.
 - i. Mounting height: A tactile sign shall be located 48" minimum to the baseline of the lowest Braille cells and 60" maximum to the baseline of the highest line of raised characters above the finish floor or ground surface.
 - j. Mounting location: A tactile sign shall be located on the approach
 - k. side, as one enters or exits rooms or space, and be reached within 0" of the required clear floor space per CBC Section and Figure 11B -703.4.2 as follows:
 - 1) Alongside a single door at the latch side.
 - 2) On the inactive leaf at double doors with one active leafs.

- 3) To the right of the right hand door at double doors with two active leafs.
 - 4) On the nearest adjacent wall where there is no wall space at the latch side of a single door or at the right side of double doors with two active leafs.
 - 5) So that a clear floor space of 18" x 18" minimum, centered on the tactile characters, is provided beyond the arc of any door swing between the closed position and 45 degree open position.
2. Visual characters shall comply with CBC Section 11B-703.5 and shall be 40" minimum above finish floor or ground.
 3. Pictograms shall comply with CBC Section 11B-703.6.
 4. Symbol of accessibility shall comply with CBC Section 11B-703.7.
 5. Variable message signs shall comply with CBC Section 11B-703.8

1.5 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.
- C. Certification:
 1. Certification: Accompanying submittal, provide sign fabricator/manufacturers written certification stating signs as designed comply with applicable criteria of ADAAG and Title 24, including letter style, spacing and size.
 2. Prior to installation, provide sign fabricator/manufacturers written certification stating tactile and braille signs comply with specified criteria, including proof-reading requirements.
- D. 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.
- E. 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. Room-Identification Signs: Full-size Sample.
 2. Panel Signs: Full-size Sample.
 3. Exposed Accessories: Full-size Sample of each accessory type.
 4. Cast AcrylicSheet: Manufacturer's color charts of actual sections of material including the full range of colors available for each material required.
 5. Full-size Samples, if approved, will be returned to Contractor for use in Project.
- F. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

1.6 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.

1.7 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 SIGNS

- 1. Solid-Sheet Sign:
 - a. Interior: Acrylic sheet, 0.25 inch thick.
 - 1) Acrylic Sheet: ASTM D 4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).
 - 2) Integral Acrylic Sheet Color: As selected by Architect
 - b. Exterior: Etched magnesium or zinc 0.125 inch thick.
 - 1) Integral Aluminum Finish: Clear anodized.
 - 2. Finish/Contrast/Color:
 - a. Finish: Provide signs with matte, non-reflective finish, with a maximum 11-19 degree gloss on 60 degree dosimeter.
 - b. Contrast: Provide signs with minimum light to dark contrast between background and message of 70 percent.
 - c. Color: Provide signs with two colors as selected by Architect from manufacturers standard color line.
 - 1) Background: Color 1, selected from very dark color range.
 - 2) Message: Color 2 selected from white or very light color range.
 - 3) International Symbol of Accessibility: White symbol on Federal Blue background.
 - 3. Finish System: Mathews acrylic polyurethane coating system, VOC approved, complying with glare finish criteria
- B. Room-Identification 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. Basis-of-Design Product: Indicated on Drawings.
 - 2. Text and Typeface: Accessible raised characters and Braille.
 - 3. Sign Size, Design, Style Criteria:
 - a. Character size: 5/8 inch minimum, maximum 2 inch height, raised 1/32 inch above surface.
 - b. Character proportion: Provide width to height ratio between 3:5 and 1:1.
 - c. Letter Style: Upper case Helvetica Regular.
 - d. Braille criteria: Provide contracted Grade 2 braille, with dots spaced 1/10 inch on center in each cell, and cells spaced 2/10 inch apart, measured from the second row of dots in the first cell to the first row of dots in the second cell. Provide dots raised 1/40 inch above surface, with slightly rounded or eased profile.
 - e. Design sign with room number on first line, room name on second, braille message on third line. Center all copy. Provide minimum 1/2 inch clear space all around braille image.

- f. Pictogram Criteria: Where pictograms are specified as room identification signage, provide pictogram centered in minimum 6 inch high space with no text or braille within this space. Provide tactile and braille message centered below pictogram.
- 4. Sign Types:
 - a. RS-1/RS-1A - Room Signs: Provide signs at locations shown on drawings. At all exterior entrance doors, provide symbol of accessibility per details.
 - b. RS-2 - Exit Signs: Provide signs at all door locations with exit signs required by Section 1006, Part 2, Title 24, CCR indicating the path of exit travel within the means of egress system.
 - c. RS-3 - Toilet Room Signs: Provide signs at locations shown on drawings. At toilets, provide symbol of accessibility per details.
 - d. RS-4 Toilet room door symbols: Provide door mounted signs, separate from room identification signage, complying with CBC Section 1117B.5, Part 2, Title 24, CCR. Provide appropriate international gender symbol on each sign. Do not put tactile and braille message on sign.
 - e. RS-5 - Room Signs: Provide identification and room number only.
 - f. RS-6 - Provide signs identifying "Area of Refuge Assistance" in compliance with Section 1007.6.5, Part 2, Title 24, CCR and ADAAG 4.3.11.5. Locate at each entrance to area of refuge assistance.
 - g. RS-7 - At each "Area of Refuge Assistance" provide instructional signage in compliance with Section 1117B.2, Part 2, Title 24, CCR on the use of area and communication systems.
 - h. SS-1 "Room Occupancy Limit - XXX".
 - i. SS-2 "Room Occupancy Limit-Diagram".
 - j. SS-3 "Max Live Load".

C. DIRECTIONAL AND INFORMATIONAL SIGNAGE

- 1. Basis-of-Design Product: As Indicated on Drawings.
- 2. Text and Typeface: Accessible raised characters and Braille.
- 3. Sign Size, Design, Style Criteria:
 - a. Character size: As required to comply with viewing distance criteria. Provide minimum 3 inch height at signs located 80 inches or greater above finish floor. Provide image raised 1/32 inch above surface.
 - b. Character proportion: Provide width to height ratio between 3:5 and 1:1.
 - c. Character stroke proportion: Provide stroke width to height ratio between 1:5 and 1:10.
 - d. Letter Style: Upper case Helvetica Regular.
- 4. Sign Types:
 - a. DS-1 - International Symbol of Accessibility: Provide signage with symbol of accessibility at accessible entrance.
 - b. DS-2 - NOT USED.
 - c. DS-3 - NOT USED.
 - d. DS-4 - Assistive Listening Device: Provide signs indicating availability of assistive listening devices in compliance with CBC Section 11B-219, Part 2, Title 24, CCR and ADAAG 4.30.7. In addition, provide message on sign stating "Contact School Administration to make arrangements for access to listening device for after school hours use".
 - e. DS-5 NOT USED
 - f. DS-6 - Elevator Evacuation Plan: Provide sign frame and clear protective cover for fire marshal required evacuation plan.

- g. DS-7A - Stair Identification : Provide sign at each stair complying with CBC Section 1020.1.6 Part 2, Title 24, CCR, identifying stairway number, roof access, floor level, and upper/lower level terminations.
- h. DS-7B - Stair Identification : Provide sign at each stair complying with CBC Section 1020.1.6 Part 2, Title 24, CCR, identifying stairway number.
- i. DS-8 - Exit Route: Provide signage indicating Exit Route. Provide signage located per plan.
- j. DS-9 -Fire Riser: Provide signage indicating Fire Riser.
- k. DS-10 - Elevator Floor Identification: Provide signage indicating floor stop.
- l. DS-11 - LEED: Provide (12) signs, location as directed by architect.

D. VEHICLE TRAFFIC CONTROL SIGNAGE

- 1. Provide painted aluminum series, design as shown on drawings and as specified, with H6-TP spanner head vandal resistant fasteners, H-5 spacer and all required mounting components. All accessible signs shall be painted with white message on dark blue background.
- 2. Post: Steel pipe, 3 inch diameter unless noted otherwise, galvanized per Section 055000.
- 3. Concrete: 3,000 psi concrete in accordance with the provisions of Section 033000. Sign Types:
 - a. VS-1 - Accessible Parking Site Entrance Sign: RFH 1824.
 - b. VS-2 - Accessible Parking Space Sign: RFH 1212PB.
 - c. VS-3 - Van Accessible Parking Space Sign: RFH 1212PB, with 2RFH-VAN - R12 at van accessible spaces.
 - d. VS-4 - No Parking Zone: R26PLZ-12 x 18 inches.
 - e. VS-5 - Right Turn Only Sign: R41R - 12 x 18 inches.
 - f. VS-6 - Do Not Enter Sign: R11R - 24 x 24 inches.
 - g. VS-7 - No Parking-Fire Lane Sign: R26RFL - 12 x 18 inches.
 - h. VS-8 - Enter Only Sign: R109R - 12 x 18 inches.
 - i. VS-9 - No Parking Ó Loading Zone: R26PLZ - 12 x 18 inches.
 - j. VS-10 Ó Stop Sign: R1R-18 x 18 inches.

E. EXTERIOR DEDICATION PLAQUE

- 1. Type: cast Bronze
- 2. Size and Construction
 - a. Size: As shown on drawings.
 - b. Thickness: 5/8 inch.
 - c. Letter Style: Raised letters, sans serif, as selected by Architect from standard line. Base contract on 50% upper and 50% lower case, two separate letter sizes and two separate letter styles.
 - d. Message: As shown on drawings. Base contract on 30 letters for each Board member name.
 - e. Finish: BR -400.
 - f. Border: No. 510.
 - g. Background: Pebble Texture.

F. EXTERIOR MARQUEE SIGN

- 1. Manufacturer: Daktronics, phone (800) 325-7446 or Stewart Daystar EXP Series or equal.
- 2. Model: Galaxy 3500 Series
 - a. Size: 6 feet x 20 feet-1 inch

- b. Mounting: Wall mounted.
- c. Character Height: 9 inches - 64 inches.
- d. Line Spacing: 34 mm, 82 pixels per square inch. 6 lines with 35 characters per line.
- e. Color Capability: 68 billion colors.
- f. LEDs per Pixel: 3 : 1 red, 1 green and 1 blue
- g. Max Brightness: 9,500 nits
- h. Graphic Capability: Text, graphics, logos, basic animation and multiple font styles and sizes.
- i. Control Software: Venus 1500.
- j. Power: 120/240 VAC single phase.
- k. Display Dimming: 64 levels.
- l. Communications: WiFi.

2.2 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. Exterior: Provide stainless steel spanner head tamper resistant screw in expansion shields suitable for substrate. Countersink screw flush with surface.
 - 2. Interior: Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.
 - 3. Signs Mounted on Glass: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign.

2.3 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 - 1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
 - 2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
 - 3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
 - 4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
 - 5. Internally brace signs for stability and for securing fasteners.
 - 6. 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. Signs with Changeable Message Capability: Fabricate signs to allow insertion of changeable messages as follows:
 - 1. For slide-in changeable inserts, fabricate slot without burrs or constrictions that inhibit function. Furnish initial changeable insert. Furnish two blank inserts for each sign for Owner's use.

2.4 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.
- C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.
- D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.5 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

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. Room-Identification Signs and Other Accessible Signage: Install in locations on walls as indicated and according to accessibility standard.
 - 1. When sign is installed on window surface or other similar recessed conditions, provide spacer as required to maintain sign face within 3 inches of outermost wall plane.

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 102116 - SOLID PLASTIC TOILET COMPARTMENTS

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. Solid-polymer toilet compartments configured as toilet enclosures and urinal screens.
- B. Related Sections:
 - 1. Section 061000 "Rough Carpentry" and Section 061035 "Miscellaneous Rough Carpentry" for blocking.
 - 2. Section 102800 "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Show locations of cutouts for compartment-mounted toilet accessories.
 - 2. Show locations of centerlines of toilet fixtures.
 - 3. Show bracing locations.
- C. Samples for Initial Selection: For each type of unit indicated. Include Samples of hardware and accessories involving material and color selection.
- D. 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 units, prepared on 6-inch-square Samples of same thickness and material indicated for Work.
 - 2. Each type of hardware and accessory.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of toilet compartment, from manufacturer.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84, or another standard acceptable to authorities having jurisdiction, 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.

1.7 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.

1.8 WARRANTY

1. Contractors Guarantee: Provide Owner with written guarantee complying with the following criteria:
 - a. Panel Material Replacement: Complete panel material replacement at no cost to Owner, including shipping to manufacturer, if panel materials exhibit , surface crazing, spading or delamination for a period of 5 years after installation.
 - b. Hardware Material Replacement: Complete hardware material replacement at no cost to Owner, including shipping to manufacturer, if hardware materials break or rust for a period of 5 years after installation.
2. Manufacturer's Warranty: Provide Owner with compartment system manufacturers written guarantee complying with the following criteria:
 - a. Panel Material Replacement: Complete panel material replacement at no cost to Owner for materials, if panel materials exhibit breakage, surface crazing, spalling or delamination for a period of 15 years after installation.
 - b. Hardware Material Replacement: Complete hardware material replacement at no cost to Owner for material cost, if hardware materials break or rust for a period of 15 years after installation.

1.9 REGULATORY REQUIREMENTS

- A. Wheelchair accessible compartment shall comply with CBC Section 11B-604.8.1.
- B. 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" high minimum above the finish floor and 6" deep minimum beyond the compartment side face of the partition, exclusive of partition support members. It shall be 12" 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" wide.
- C. 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.
- D. 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" clear, rather than 60". CBC Figure 11B-604.8.2.
- E. A door pull complying with CBC Section 11B-404.2.7 shall be placed on both sides of the door near the latch.
- F. Doors shall not swing into clear floor space or clearance required for any fixtures.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Castings: ASTM B 26/B 26M.

- B. Aluminum Extrusions: ASTM B 221.
- C. Stainless-Steel Castings: ASTM A 743/A 743M.

2.2 SOLID-POLYMER UNITS

- 1. Manufacturers: Subject to compliance with requirements, provide products Scranton Products, Paisley or equal
- B. Toilet-Enclosure Style: Floor mounted/Overhead braced.
- C. Urinal-Screen Style: Wall hung.
- D. Door, Panel, Screen, and Pilaster Construction: Solid, high-density polyethylene (HDPE) panel material, not less than 1 inch thick, seamless, with eased edges, no-sightline system, and with homogenous color and pattern throughout thickness of material.
 - 1. Integral Hinges: Configure doors and pilasters to receive integral hinges.
 - 2. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum or stainless-steel strip fastened to exposed bottom edges of solid-polymer components to prevent burning.
 - 3. Color and Pattern: as selected by Architect from manufacturer's full range.
- E. Pilaster Shoes and Sleeves (Caps): Manufacturer's standard design; plastic.
- F. Brackets (Fittings):
 - 1. Full-Height (Continuous) Type: 54 and 68 inches long, heavy-duty aluminum, bright dip anodized finish, fastened to pilasters and panels with stainless steel tamper resistant Torx head sex bolts Manufacturer's standard design; extruded aluminum or stainless steel.

2.3 ACCESSORIES

- A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.
 - 1. Material: Aluminum or Stainless steel hardware components. ZAMAC components are not acceptable
 - 2. Hinges: Manufacturer's standard continuous, cam type that swings to a closed or partially open position.
 - 3. Latch and Keeper:
 - a. 6 inches long, fabricate from heavy-duty extruded aluminum with bright dip anodized finish, with wrap-around flanges secured to pilasters with stainless steel tamper resistant Torx head sex bolts.
 - b. Slide door latch with exterior emergency access feature at all compartment doors.
 - 4. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.
- B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish. Profile configuration free of locations suitable for concealing contraband in rail.
- 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.

2.4 FABRICATION

- A. 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.
- B. Door Size and Swings: Unless otherwise indicated, provide 24-inch-wide, in-swinging doors for standard toilet compartments and 36-inch-wide, out-swinging doors with a minimum 32-inch-wide, clear opening for compartments designated as accessible.
- C. Doors and Dividing Panels: 55 inches high, mounted 14 inches above finished floor, with aluminum heat-sinc fastened to bottom edges.
- D. Pilasters: 82 inches high, fastened to pilaster sleeves with stainless steel tamper resistant Torx head sex bolt, with stainless steel angle attachment to floor and ceiling.
- E. Urinal screen: 15 inches wide, 36 inches high mounted 14 inches above finish floor.

PART 3 - EXECUTION

3.1 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: 1/4 inch.
 - b. Panels and Walls: 1 inch.
 - 2. Stirrup Brackets: Secure panels to walls and to pilasters with full height continuous type.
 - a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints, where possible.
 - b. Align brackets at pilasters with brackets at walls.
- B. Verify that work of this section may be installed in strict accordance with the original design, all pertinent codes and regulation and all pertinent portions of the referenced standards.
 - 1. Verify correct spacing of and between plumbing fixtures
 - 2. Verify correct location of anchorage.
- C. 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.
- D. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.2 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 102116

SECTION 102600 - WALL AND DOOR PROTECTION

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. Corner guards.
- B. Related Requirements:
 - 1. Section 087100 "Door Hardware" for metal protective trim units, according to BHMA A156.6, used for armor, kick, mop, and push plates.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For each type of wall and corner protection showing locations and extent.
 - 1. Include plans, elevations, sections, and attachment details.
- C. Samples for Initial Selection: For each type of impact-resistant wall-protection unit indicated, in each color and texture available from the manufacturer.
- D. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:
 - 1. Corner Guards: 12 inches long. Include example top caps.

1.4 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each type of exposed plastic material.
- B. Qualification Data: For installer.
- C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of wall and corner protection product to include in maintenance manuals.
 - 1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

1.6 QUALITY ASSURANCE

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

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store wall and corner protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
 - 1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
 - 2. Keep plastic materials out of direct sunlight.
 - 3. Store plastic wall-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.
 - a. Store corner-guard covers in a vertical position.
 - b. Store wall-guard covers in a horizontal position.

1.8 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls, columns, and other construction contiguous with impact-resistant wall-protection units by field measurements before fabrication and indicate measurements on Shop Drawings.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and corner-protection units that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
 - b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain wall- and corner-protection products each from a single source and from a single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. 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.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in the CBC, and the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities.

2.3 CORNER GUARDS

- A. Surface-Mounted, Metal Corner Guards Fabricated as one piece from formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Balco, Inc.

- b. Construction Specialties, Inc.
 - c. InPro Corporation (IPC).
 - d. Or Equal.
- 2. Material: Stainless-steel sheet, Type 304.
 - a. Thickness: Minimum 0.0625 inch.
 - b. Finish: Directional satin, No. 4.
- 3. Wing Size: Nominal 2 by 2 inches.
- 4. Height: 8 feet or full height of opening.
- 5. Corner Radius: 1/8 inch.
- 6. Mounting: Flat-head, countersunk screws through factory-drilled mounting holes.

2.4 MATERIALS

- A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.
- B. Polycarbonate Plastic Sheet: ASTM D 6098, S-PC01, Class 1 or Class 2, abrasion resistant; with a minimum impact-resistance rating of 15 ft.-lbf/in. of notch when tested according to ASTM D 256, Test Method A.
- C. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.
- D. Adhesive: As recommended by protection product manufacturer.

2.5 FABRICATION

- A. Fabricate wall and corner protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.
- B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.
- C. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.6 FINISHES

- A. Protect 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 and wall areas, with Installer present, for compliance with requirements for installation tolerances, fire rating, and other conditions affecting performance of the Work.

- B. Examine walls to which wall and corner protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
 - 1. For wall and corner protection attached with adhesive, 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.

3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing wall and corner protection.
- B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

- A. Installation Quality: Install corner protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

3.4 CLEANING

- A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.
- B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102600

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Public-use washroom accessories.
 - 2. Public-use shower room accessories.
 - 3. Warm-air dryers.
 - 4. Under-lavatory guards.
 - 5. Custodial accessories.

1.3 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.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.6 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.

1.7 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.

1.8 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.

1.9 REGULATORY REQUIREMENTS

1. Accessible toilet accessories shall be mounted at heights and at horizontal locations according to CBC Title 24.
2. Toilet paper dispensers and feminine napkin disposal units located on the grab bar side of an accessible toilet room or stall shall not project more than 3-inches from the finished wall surface nor be located closer than 1-1/2-inch clear of the tangent point of the grab bar.
3. Elements of Sanitary facilities shall be mounted at locations in compliance with
4. CBC Sections 11B-602 through 11B-612.
5. Grab bars in toilet facilities and bathing facilities shall comply with CBC Section 11B-609. Grab bars and any wall or other surfaces adjacent to grab bars shall be free of sharp or abrasive elements and shall have rounded edges. The space around the grab bars shall be as follows:
 - a. 1 ½ between the grab bar and the wall.
 - b. 1 ½ minimum between the grab bar and projecting objects below and at the ends.
 - c. 12 minimum between the grab bar and projecting objects above.

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 PUBLIC-USE WASHROOM ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:
1. Bobrick Washroom Equipment, Inc.

2. Bradley Corporation.

B. Toilet Tissue (Roll) Dispenser -TPD-1 (For Accessible Stalls Only):

1. Basis-of-Design Product: BBobrick B-3888.
2. Mounting: Recessed, 3 inch max projection.
3. Capacity: Designed for 5-inch- diameter tissue rolls.
4. Material and Finish: Stainless steel, No. 4 finish (satin).

C. Toilet Tissue (Jumbo-Roll) Dispenser (OFOI) TPD-2 :

1. Basis-of-Design Product: Kimberly-Clark, Code 09608, Coreless JRT Twin Bathroom Tissue Dispense.
2. Mounting: Surface mounted.
3. Capacity: 9- or 10-inch- diameter rolls.
4. Material and Finish: Stainless steel, No. 4 finish (satin) .
5. Lockset: Tumbler type.
6. Refill Indicator: Pierced slots at front.

D. Paper Towel Dispenser (OFOI) PTD-1 :

1. Basis-of-Design Product: Bobrick, B-3942.
2. Mounting: Surface Mounted, 4 inch max projection.
3. Material and Finish: Stainless steel, No. 4 finish (satin).

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E. Waste Receptacle WR-1 (OFOI):

1. Basis-of-Design Product: Bobrick , B-2300.

F. Liquid-Soap Dispenser (OFOI) SD-1:

1. Basis-of-Design Product: Kimberly-Clark Cassette Skin Care System dispenser, Code 92145.
2. Mounting: Vertically oriented, surface mounted.

G. Grab Bar GB-1:

1. Basis-of-Design Product: Bobrick, B-5806 x 42.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 18-gauge.
 - a. Finish: Smooth, No. 4 finish (satin).
4. Outside Diameter: 1 1/2 inch
5. Configuration and Length: Straight 42 inches.

H. Grab Bar GB-2:

1. Basis-of-Design Product: Bobrick, B-5806 x 36.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 18-gauge.
 - a. Finish: Smooth, No 4 finish.
4. Outside Diameter: 1 1/2 inch
5. Configuration and Length: Straight 36 inches.

1

I. Sanitary-Napkin Disposal Unit (OFOI) SND-1:

1. Basis-of-Design Product: Bobrick, B-270.
2. Mounting: Recessed.
3. Receptacle: Removable.
4. Material and Finish: Stainless steel, No. 4 finish (satin).

J. Seat-Cover Dispenser (OFOI) SCD-1:

1. Basis-of-Design Product: Bobrick, B-221.

2. Mounting: Surface mounted .
3. Exposed Material and Finish: Stainless steel, No. 4 finish (satin).

K. Mirror Unit M-1:

1. Basis-of-Design Product: Bobrick, B165 1836.
2. Frame: Stainless-steel channel .
 - a. Corners: Mitered and mechanically interlocked.
3. Hangers: Produce rigid, tamper- and theft-resistant installation.
4. Size: 18 inches wide by 36 inches tall.

2.3 WARM-AIR DRYERS

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick, B-750 .
2. Mounting: Recessed.
3. Operation: Electronic-sensor activated with timed power cut-off switch.
 - a. Operation Time: 1 1/2 minutes.
4. Cover Material and Finish: 16-gauge steel with baked enamel finish, rust
5. resistant.
6. Electrical Requirements: 110-127 V.



2.4 UNDERLAVATORY GUARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:
 1. Truebro by IPS Corporation.
- B. Underlavatory Guard:
 1. Basis-of-Design Product: Truebro, Lav Guard2.
 2. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.
 3. Material and Finish: Antimicrobial, molded plastic, white.

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 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 104413 - FIRE EXTINGUISHER CABINETS

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. Fire-protection cabinets for the following:
 - a. Portable fire extinguishers.
- B. Related Requirements:
 - 1. Section 104416 "Fire Extinguishers."

1.3 PRE-INSTALLATION CONFERENCE

- A. Pre-installation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to fire-protection cabinets including, but not limited to, the following:
 - a. Schedules and coordination requirements.

1.4 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, semirecessed, or surface-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. Samples: For each type of exposed finish required.
- D. 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.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Fire Extinguisher Cabinets must comply with CBC Sections 11B-307, 11B-308, 11B-309, and 11B-403.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.7 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.

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. Cabinet Type: Suitable for fire extinguisher.
 - 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. Potter Roemer LLC.
 - d. Or Equal.
- B. Cabinet Construction: Nonrated and 1-hour fire rated.
 - 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.
- C. Cabinet Material: Cold-rolled steel sheet.
- D. 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.
- E. Cabinet Trim Material: Steel sheet.
- F. Door Material: Steel sheet.
- G. Door Style: Fully glazed panel with frame.
- H. Door Glazing: Tempered float glass (clear).
- I. 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 latch operable with 5 lbs. maximum force.
 - 2. Provide continuous hinge of same material and finish as trim, permitting door to open 180 degrees.
- J. 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 cabinet door.
 - 2) Application Process: Pressure-sensitive vinyl letters.
 - 3) Lettering Color: Red.
 - 4) Orientation: Vertical.
- K. Materials:

1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
 - a. Finish: Baked enamel or powder coat.
 - b. Color: Gloss white.
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.
- 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

3.1 EXAMINATION

- A. Examine roughing-in for cabinets to verify actual locations before cabinet installation.
- B. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.
- C. 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. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights indicated below:
 1. Mount Fire Protection Cabinets to provide a handle height for both the Fire-Protection Cabinet and Fire Extinguisher at a maximum 48 inches above finished floor. The

bottom of surface-mounted Fire Extinguisher Cabinets shall not exceed 27 inches above finished floor.

- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide semi-recessed fire-protection cabinets at one hour rated walls and non rated cabinets at non rated walls.
 - 2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
- C. Identification: Apply 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.
- 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 104416 - FIRE EXTINGUISHERS

Revise this Section by deleting and inserting text to meet Project-specific requirements.

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 portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.
- B. Related Requirements:
 - 1. Section 104413 "Fire Protection Cabinets."

1.3 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.

1.4 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. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.7 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.8 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: Five 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.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amerex Corporation.
 - b. Ansul Incorporated; Tyco International.
 - c. Potter Roemer LLC.
 - d. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - e. Or Equal.
 - 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.
- B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 2-A:10-B:C, 5-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

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. General: Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.
 - 1. Mount Fire Extinguishers to provide handle height at a maximum of 48" above finish floor, and the bottom of the fire extinguisher is at a maximum of 27" above finish floor.

END OF SECTION 104416

SECTION 107500 - FLAGPOLES

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 ground-mounted flagpoles made from aluminum .

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes for flagpoles.
- B. Shop Drawings: For flagpoles. Include plans, elevations, details, and attachments to other work. Show general arrangement, jointing, fittings, accessories, grounding, anchoring, and support.
 - 1. Include section, and details of foundation system for ground-mounted flagpoles.
- C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified professional engineer.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain flagpole as complete unit, including fittings, accessories, bases, and anchorage devices, from single source from single manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. General: Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

1.8 REGULATORY REQUIREMENTS

- A. All flagpole hardware shall comply with Height and Operation requirements of CBC Sections 11B-309.3 and 11B-309.4.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:
 - 1. American Flagpole.

2. Concord American Flagpole, Inc.
3. Pole-Tech Company Inc.
4. U.S. Flag & Flagpole Supply, LP.
5. Or Equal.

2.2 FLAGPOLES

- A. Flagpole Construction, General: Construct flagpoles in one piece if possible. If more than one piece is necessary, comply with the following:
 1. Fabricate shop and field joints without using fasteners, screw collars, or lead calking.
 2. Provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.
 3. Provide self-aligning, snug-fitting joints.
- B. Exposed Height: 60 feet.
- C. Aluminum Flagpoles: Provide cone -tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B 241/B 241M, Alloy 6063, with a minimum wall thickness of 7 inch butt diameter x .188 inch.
- D. Metal Foundation Tube: Manufacturer's standard corrugated-steel foundation tube, not less than 0.064-inch- nominal wall thickness. Provide with 3/16-inch steel bottom plate and support plate; 3/4-inch- diameter, steel ground spike; and steel centering wedges welded together. Galvanize steel after assembly. Provide loose hardwood wedges at top of foundation tube for plumbing pole.
 1. Provide flashing collar of same material and finish as flagpole.
- E. Sleeve for Aluminum Flagpole: foundation sleeve, made to fit flagpole, for casting into concrete foundation.
 1. Provide flashing collar of same material and finish as flagpole.
 2. Provide ground spike at grade-mounted flagpoles.
 3. Provide braces, turnbuckles, and connectors made from same metal and with same finish as flagpoles.

2.3 FITTINGS

- A. Finial Ball : Manufacturer's standard flush-seam ball, sized as indicated or, if not indicated, to match flagpole-butt diameter.
 1. 14 gage spun aluminum ball with gold anodic finish.
- B. External Halyard : Ball-bearing, nonfouling, revolving truck assembly of cast metal with continuous 5/16-inch- diameter, braided polypropylene halyard and 9-inch cast-metal cleats with fasteners. Finish exposed metal surfaces to match flagpole.
 1. Provide one halyard and one cleat at each flagpole.
 2. Provide cast-metal cleat covers, finished to match flagpole, secured with cylinder locks.
 3. Provide halyard covers consisting of a 2-inch channel, 60 inches long, finished to match flagpole.
 4. Halyard Flag Snaps: Provide two chromium-plated bronze swivel snap hooks per halyard.
 - a. Provide with neoprene or vinyl covers.

2.4 MISCELLANEOUS MATERIALS

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.

- B. Drainage Material: Crushed stone, or crushed or uncrushed gravel; coarse aggregate.
- C. Sand: ASTM C 33, fine aggregate.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

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. 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.

2.6 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

2.7 STEEL FINISHES

- A. Flagpole Interior Finish: Apply one coat of bituminous paint on interior of flagpole or otherwise treat to prevent corrosion.

2.8 FLAGS

- A. Provide flags, size as recommended by manufacturer for pole height, polyester material, reinforced corners and vertical stitching.
- B. Provide United States of America and California State flag.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, including foundation; accurate placement, pattern, orientation of anchor bolts, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.

3.3 FLAGPOLE INSTALLATION

- A. General: Install flagpoles where shown and according to Shop Drawings and manufacturer's written instructions.
- B. Foundation Tube: Place flagpole in tube, seated on bottom plate between steel centering wedges, and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch layer of elastomeric joint sealant and cover with flashing collar.

END OF SECTION 107500

SECTION 11 66 23 - ATHLETIC EQUIPMENT

1

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Exterior basketball backstops.
- B. Tetherball unit.

1.2 QUALITY ASSURANCE

- A. For convenience in identifying equipment items, manufacturer's catalog numbers are scheduled. Unless modified by Specifications or notation on Drawings, catalog description for indicated number shall constitute basic requirements for each item. Equipment shall incorporate all features set forth in catalog for standard item, except for specified modifications to such items.

1.3 SUBMITTALS

- A. Refer to Section 01 33 00.
 - 1. Manufacturer's data: Submit for each piece of equipment, indexed with complete list of equipment and locations.
 - 2. Show drawings: Submit Shop drawings showing locations of all equipment and service connections where required. Show all anchorage, footings and connection details.
 - 3. Certification: provide certification of flame resistance as required.
 - 4. Samples: Submit for color selection by Architect where indicated.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver to job until notified by Contractor that building is in proper condition and arrangements have been made to properly handle, store and protect work.
- B. Deliver in sections to fit openings.

1.5 WARRANTY

- A. Backboard: Provide Owner with Manufacturers Lifetime Labor and Material Warranty, In Architect approved form, against breakage during normal use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Characteristics of specific products, where named in this Section, are indicated to establish required level of quality, appearance, and performance. The Architect will review requests for substitutions, under the provisions of Section 01 25 00.
- B.

2.2 EXTERIOR BASKETBALL GOALS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Porter Athletic Equipment Company.; Heavy-Duty Basketball System, 00195580 or provide products by one of the following.
 - 1. Draper Inc.
 - 2. Jaypro Sports.

3. Or Equal.
- B. Protruding fasteners or exposed bolt heads on front face of backboards are not permitted.
- C. Basketball Backboard:
 1. Shape and Size:
 - a. Rectangular, 72 by 42 inches width by height.
 2. Backboard Material: With predrilled holes or preset inserts for mounting goals, and as follows:
 - a. Steel: Single-piece, steel face sheet, not less than 11 gauge nominal thickness, with 1-1/2-inch- deep, roll-edged perimeter flange and with steel-reinforced, welded frame welded to back side of backboard; with mounting slots for mounting backboard frame to backboard support framing at standard mounting centers.
 3. Target Area and Border Markings: Marked in orange, with manufacturer's standard pattern and stripe width.
 4. Finish: Manufacturer's standard factory-applied, white background.
- D. Goal Mounting Assembly: Compatible with goal, backboard, and support framing; with hole pattern that is manufacturer's standard for goal attachment.
- E. Basketball Goals: Complete with flanges, braces, attachment plate, and evenly spaced loops welded around underside of ring.
 1. Double-Rim Basket Ring: Fabricated with 2 rims, each consisting of 5/8-inch- diameter steel rod welded into 18-inch ID rings.
 2. Type: Fixed, nonmovable.
 3. Finish: Powder-coat finish.
- F. Basketball Nets: Nylon net.

2.3 TETHERBALL UNIT

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Porter Athletic Equipment Company; Porter No. 00763200 Teatherball Post and Ball.
 1. Ground Sleeve; Porter No. 00402000.
 - a. Sleeve shall be PVC. Sleeve shall be 2 feet 4 inches in total length with a 1/2 inch diameter locating/anchor pin located 2 feet below the playing surface. Bottom end of sleeve shall be open to allow for drainage into the gravel base beneath the concrete footing.

2.4 OTHER MATERIALS

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

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for play court layout, alignment of mounting substrates, installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance.

1. Verify critical dimensions.
2. Examine supporting structure and subfloors and footings below finished floor.
3. Examine wall assemblies, where reinforced to receive anchors and fasteners, to verify that locations of concealed reinforcements have been clearly marked. Locate reinforcements and mark locations.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Comply with manufacturer's written installation instructions and competition rules indicated for each type of gymnasium equipment. Complete equipment field assembly, where required.
- B. Unless otherwise indicated, install gymnasium equipment after other finishing operations, including painting, have been completed.
- C. Permanently Placed Gymnasium Equipment and Components: Rigid, level, plumb, square, and true; anchored securely to supporting structure; positioned at locations and elevations indicated on Shop Drawings; in proper relation to adjacent construction; and aligned with court layout.
 1. Floor Insert Location: Coordinate location with application of game lines and markers.
 2. Floor Insert Elevation: Coordinate installed heights of floor insert with installation and field finishing of finish flooring and type of floor plate.
 3. Operating Gymnasium Equipment: Verify clearances for movable components of gymnasium equipment throughout entire range of operation and for access to operating components.
- D. Anchoring to In-Place Construction: Use anchors and fasteners where necessary for securing built-in and permanently placed gymnasium equipment to structural support and for properly transferring load to in-place construction.

3.3 ADJUSTING

- A. Adjust movable components of gymnasium equipment to operate safely, smoothly, easily, and quietly, free from binding, warp, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and moving parts.

3.4 CLEANING

- A. After completing gymnasium equipment installation, inspect components. Remove spots, dirt, and debris and touch up damaged shop-applied finishes according to manufacturer's written instructions.
- B. Replace gymnasium equipment and finishes that cannot be cleaned and 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 gymnasium equipment. Refer to Section 01 79 00 "Demonstration and Training."

END OF SECTION 11 66 23

SECTION 116800 - PLAY FIELD EQUIPMENT AND STRUCTURES

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 freestanding and composite structure playground equipment.
- B. DEFINITIONS
- C. Fall Height: According to ASTM F 1487, "the vertical distance between a designated play surface and the protective surfacing beneath it."
- D. HDPE: High-density polyethylene.
- E. LLDPE: Linear low-density polyethylene.
- F. MDPE: Medium-density polyethylene.
- G. Use Zone: According to ASTM F 1487, the "area beneath and immediately adjacent to a play structure or equipment that is designated for unrestricted circulation around the equipment and on whose surface it is predicted that a user would land when falling from or exiting the equipment."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For playground equipment and structures. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples for Initial Selection: For each type of playground equipment and structure indicated.
 - 1. Manufacturer's color charts.
 - 2. Include similar Samples of playground equipment and accessories involving color selection.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 - 1. Posts and Rails: Not less than 6 inches long.
 - 2. Platforms: Not less than 6 inches square.
 - 3. Molded Plastic: Not less than 3 inches square.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Extent of surface systems and use zones for equipment.
 - 2. Critical heights for playground surfaces and fall heights for equipment.
- B. Qualification Data: For qualified installer.
- C. Product Certificates: For each type of playground equipment, from manufacturer.

- D. Material Certificates: For the following items, signed by manufacturers:
 - 1. Shop finishes.
 - 2. Recycled plastic.
 - E. Retain first paragraph below if Contractor is responsible for field quality-control testing and inspecting.
 - F. Warranty: Sample of special warranty.
- 1.5 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For playground equipment and finishes to include in maintenance manuals.
- 1.6 QUALITY ASSURANCE
- A. Installer Qualifications: An employer of workers approved by manufacturer.
 - B. Safety Standards: Provide playground equipment complying with or exceeding requirements in ASTM F 1487
- 1.7 WARRANTY
- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of playground equipment that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Period: Fiveyears from date of Substantial Completion.
- 1.8 REGULATORY REQUIREMENTS
- 1. Play areas along with number and types of play components shall comply with scoping requirements of CBC Section 11B-240.
 - 2. Play areas with play components and structures provided shall comply with CBC Section 11B-1008.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain playground equipment from single source from single manufacturer.
- B. Playground equipment and components shall have the IPEMA Certification Seal.
- C. Subject to compliance with requirements, provide products from one of the following. Products from other manufacturers will not be considered.
 - 1. Playworld.
 - 2. GameTime, a Playcore Company.
 - 3. little tikes.
 - 4. Miracle.
 - 5. Park Structures, Inc.

2.2 PERFORMANCE REQUIREMENTS

- A. Safety Standard: Provide playground equipment complying with or exceeding the requirements of CPSC No. 325, "Handbook for Public Playground Safety."• Label playground equipment and structures with warning label and manufacturer's identification per ASTM F 1487.

2.3 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1.
 - 2. Cast Aluminum: ASTM B 179.
 - 3. Flat Sheet: ASTM B 209.
- B. Steel: Comply with the following:
 - 1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M, hot-dip galvanized.
 - 2. Steel Pipe: ASTM A 53/A 53M or ASTM A 135/A 135M standard-weight, hot-dip galvanized.
 - 3. Steel Tubing: ASTM A 513, cold formed, hot-dip galvanized.
 - 4. Steel Sheet: ASTM A 1011/A 1011M, hot-dip galvanized not less than G60 coating designation
 - 5. Perforated Metal: Steel sheet not less than 0.120-inchuncoated thickness; hot-dip galvanized; manufacturer's standard perforation pattern.
 - 6. Expanded Metal: Manufacturer's standard carbon-steel sheets complying with ASTM F 1267, Type II (expanded and flattened); deburred after expansion.
 - 7. Woven Wire Mesh: Manufacturer's standard, with wire complying with ASTM A 510.
- C. Opaque Plastic: Color impregnated, UV stabilized, and mold resistant.
 - 1. Polyethylene: Fabricated from plastic resin; rotationally molded HDPE, LLDPE, or MDPE with not less than 1/4-inch wall thickness.
- D. Transparent Plastic: Abrasion-resistant, UV-stabilized monolithic polycarbonate sheet; clear, colorlessnot less than 3/16 inch thick.
- E. Chain and Fittings: ASTM A 467/A 467M, Class CS, 4/0 or 5/0, welded-straight-link coil chain; PVC coated. With commercial-quality, hot-dip galvanized steel connectors and swing or ring hangers.
- F. Castings and Hangers: Malleable iron, ASTM A 47/A 47M, Grade 32510, hot-dip galvanized.
- G. Post Caps: Cast aluminum; color to match posts.
- H. Platform Clamps and Hangers: Cast aluminum.
- I. Hardware: Manufacturer's standard; commercial-quality; corrosion-resistant; hot-dip galvanized steel and iron, stainless steel, or aluminum; of a secure and vandal-resistant design.
- J. Fasteners: Manufacturer's standard; corrosion-resistant; hot-dip galvanized or plated steel and iron, or stainless steel; permanently capped, and theft resistant.
- K. Recycled Content:
 - 1. Plastic: Minimum 90 percent total recycled content, with minimum 90 percent post-consumer recycled content.
 - 2. BOF Steel: Minimum 16 percent total recycled content, with minimum16 percent post-consumer recycled content.

3. EAF Steel: Minimum 67 percent total recycled content, with minimum 67 percent post-consumer recycled content.
4. Aluminum: Minimum 25 percent total recycled content, with minimum 25 percent post-consumer recycled content.

2.4

A.

- 1.
2. Kiln-dry lumber and plywood after treatment to a maximum moisture content, respectively, of 19 and 15 percent. Do not use materials that are warped or do not comply with requirements for untreated materials.

2.5 PLAYGROUND EQUIPMENT FABRICATION

- A. General: Provide sizes, strengths, thicknesses, wall thickness, and weights of components as indicated but not less than required to comply with structural performance and other requirements in ASTM F 1487. Factory drill components for field assembly. Unnecessary holes in components, not required for field assembly, are not permitted. Provide complete play structure, including supporting members and connections, means of access and egress, designated play surfaces, barriers, guardrails, handrails, handholds, and other components indicated or required to comply with referenced standards for equipment indicated.
- B. Wood Frame: Fabricate main-frame upright support posts from wood species and with profile and dimensions as indicated. Fabricate secondary frame members, bracing, and connections from wood, steel, or aluminum.
- C. Composite Frame: Fabricate main-frame upright support posts from metal and plastic with profile and dimensions as indicated. Fabricate secondary frame members, bracing, and connections from either steel or aluminum.
- D. Play Surfaces: Provide manufacturer's standard elevated drainable decks, platforms, landings, walkways, ramps, and similar transitional play surfaces, designed to withstand loads; fabricated from perforated or expanded metal made into floor units with slip-resistant foot surfaces. Fabricate units in manufacturer's standard modular sizes and shapes to form assembled play surfaces indicated.
 1. Elevated Play Surfaces: Provide protective devices, completely surrounding play surface except for access openings, if play-surface heights above protective surfacing exceed requirements in ASTM F 1487.
 2. Stepped Play Surfaces: Provide protective infill between stepped platforms.
- E. Protective Barriers: Fabricated such that openings within the barrier and between the barrier and the play surface preclude passage of the torso probe according to ASTM F 1487. Provide barriers designed to minimize the possibility of climbing, free of hand- and footholds, and configured to completely surround the protected area except for access openings. Extend barriers above the protected elevated surface for use by age group indicated. Fabricate from the following:
 1. Welded metal pipe or tubing with vertical bars.
 2. Steel sheet with openings for vision and ventilation.
 3. Metal-pipe or -tubing frame with wire mesh infill panels.
- F. Handrails: Welded metal pipe or tubing, OD between 0.095 to 1.55 inches

- G. Roofs and Canopies: Manufacturer's standard, designed to be positioned overhead and to discourage and minimize climbing by users.
1. Signs: Manufacturer's standard sign panels, fabricated from opaque plastic with graphics molded in, attached to upright support posts.
 2. Minimum informational content according to ASTM F1487
- H. 2.6
- I. PLAYGROUND EQUIPMENT AND STRUCTURES Basis-of-Design Product: Subject to compliance with requirements, provide Miracle Recreation, or equal, as distributed by Miracle Playground Sales 800-264-7225x108 kelly.spence@miracleplayground.com
- 1.
 2. COMPONENT LIST:
 3. Qty Model No. Description
 4. 1 7145109 RECT OPEN DECK (ATTACHES TO 6 POSTS)
 5. 6 7145508 5" OD X 252" POST FOR 8' DECK W/TOPPER
 6. 2 7145019 TRIANGLE DECK (ATTACHES TO 3 POSTS)
 7. 12 714552 5" OD X 136" POST (3' TO 5' DECKS)
 8. 2 71495949 ADA STAIRS BETWEEN DECKS W/2' RISE 4' SPAN
 9. 4 7145029 SQUARE DECK (ATTACHES TO 4 POSTS)
 10. 8 7145494 5" OD X 124" POST (4 DECK)
 11. 3 714551 5" OD X 106" POST (2'6" DECKS OR LESS)
 12. 1 71485149 SQUARE TRANSFER POINT W/CLOSED HR (4' DECK)
 13. 1 71474869U 6'6" TYP II SLIDE 360D DOMED WAVE (6'&6'6"DK)
 14. 1 7146385U GROOVE II SLIDE VORTEX (5' DECK)
 15. 1 71468251 AVALANCHE INCLUSIVE SLIDE W/MESH (5' DECK)
 16. 1 7146595 PHYSICS LINKZ BUTTERFLY 8' SPAN
 17. 1 4541 CROSSWAY CLIMBER LARGE
 18. 1 7188522 3 1/2" OD ARCH SWG FRAME ONLY 2 SEATS REQ MC
 19. 1 7188522X 3 1/2" OD ARCH ADD-A-BAY 2 SEATS REQ MC
 20. 1 7188522HHX 3 1/2" OD ARCH ADD-A-BAY 8' TR GEN SEAT MC
 21. 2 2740 SWG PART THERAPEUTIC SWG SEAT W/CHAIN (8' TR)
 22. 4 2840 SWG PART SLASH PROOF SEAT W/CHAIN (8' TR)
 23. 2 7148131 DECK ENCLOSURE W/ONE SIDED OPENING
 24. 1 7146045 INVERTED HORIZONTAL LOOP LADDER (ONLY)
 25. 1 7148135 DECK ENCL FOR OVERHEAD CLIMBERS (ONLY)
 26. 1 71481552 END LADDER 2' TOP RUNG FOR OH CLIMBER
 27. 1 7147784 INCLINED SPIDER CLIMBER (3' & 4' DECK)
 28. 1 7146055 TREE-O CLIMBER (5' DECK)
 29. 1 714856L9 90 DEG LEVEL RAMP BETWEEN DECKS
 30. 1 714720 OUTRIGGER CLIMBER (5 & 6'6" DECK)
 31. 1 7148486 TWISTER CLIMBER (6' 6" DECK)
 32. 1 714554 5" OD X 178" POST (7' TO 8' DECKS)
 33. 1 71499269A KIDS' PERCH W/EXTENDED WHEEL
 34. 1 71471520 INTERACTIVE PANEL FRAME
 35. 1 71471311 SENSORY PANEL TEXTURED STAR CIRCLE

36. 1 71471312B SENSORY PANEL TEXTURED TRIANGLE HEXAGON
BD
37. 2 714553 5" OD X 160" POST (5'6" TO 6'6" DECKS)
38. 2 7148131 DECK ENCLOSURE W/ONE SIDED OPENING
39. 1 71465756 JAX ON DECK POST (4'6", 5' & 5'6" DECKS)
40. 1 714815 VERTICAL LADDER CLIMBER (5' DECK)
41. 2 7148173B SINGLE POD SEAT
42. 1 71466920PFR PLAYCOVER PYRAMID 20' X 20', FLAME
RETARDANT
43. 1 714613H5 WAVE WALKER HIP CLIMBER BETWEEN DECKS
(ONLY)
44. 2 7148435 CHINNING BAR (ONLY)
45. 1 71460055 PEAK CLIMBER W/HANDRAIL (ONLY)
46. 2 714782 CRUNCH STATION
47. 1 7147155B JUMP PANEL (5' DECK) BELOW DECK
48. 1 7148135 DECK ENCL FOR OVERHEAD CLIMBERS (ONLY)
49. 1 4542 CROSSWAY CLIMBER SMALL
50. 1 714715205 FOUR-THE-WIN INSERT
 - a. Color: As selected by Architect from manufacturer's full range.
51. Age Appropriateness: 5 through 12 years

2.6 CAST-IN-PLACE CONCRETE

- A. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete"

2.7 ALUMINUM FINISHES

- A. Baked-Enamel or Powder-Coat Finish: A minimum dry film thickness of 3 to 5 mils, medium gloss. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
- B. PVC Finish: Manufacturer's standard, UV-stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on, PVC-plastisol finish, with flame retardant added, complying with coating manufacturer's written instructions for pretreatment, application, and minimum dry film thickness of 100 mils.

2.8 IRON AND STEEL FINISHES

- A. 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. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of
- B. PVC Finish: Manufacturer's standard, UV-stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on, PVC-plastisol finish, with flame retardant added, complying with coating manufacturer's written instructions for pretreatment, application, and minimum dry film thickness of 100 mils.

2.9 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

- B. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, site surface and subgrade drainage, and other conditions affecting performance of the Work.
 - 1. Do not begin installation before final grading required for placing protective surfacing is completed unless otherwise permitted by Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Verify locations of playground perimeter and pathways. Verify that playground layout and equipment locations comply with requirements for each type and component of equipment.

3.3 INSTALLATION, GENERAL

- A. General: Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Anchor playground equipment securely, positioned at locations and elevations indicated.
 - 1. Maximum Equipment Height: Coordinate installed heights of equipment and components with finished elevations of protective surfacing. Set equipment so fall heights and elevation requirements for age group use and accessibility are within required limits. Verify that playground equipment elevations comply with requirements for each type and component of equipment.
- B. Post and Footing Excavation: Excavate holes for posts and footings as indicated in firm, undisturbed or compacted subgrade soil.
- C. Post Set with Concrete Footing: Comply with ACI 301 for measuring, batching, mixing, transporting, forming, and placing concrete.
 - 1. Set equipment posts in concrete footing. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at the correct angle, alignment, height, and spacing.
 - a. Place concrete around posts and vibrate or tamp for consolidation. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.
 - 2. Embedded Items: Use setting drawings and manufacturer's written instructions to ensure correct installation of anchorages for equipment.
 - 3. Concrete Footings: Smooth top, and shape to shed water.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a playground safety inspector, certified by the National Playground Safety Institute, to perform tests and inspections.
 - 1. Playground equipment items will be considered defective if they do not pass tests and inspections.

END OF SECTION 116800

SECTION 122116 - VERTICAL LOUVER BLINDS

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. Vertical louver blinds with PVC vanes.
 - 2. Motorized operators.
- B. Related Requirements:
 - 1. Section 061000 "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting vertical louver blinds and accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For vertical louver blinds, include fabrication and installation details.
 - 1. Motorized Operators: 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, 12 inches long.
- D. Samples for Initial Selection: For each type of vertical louver blind.
 - 1. Include Samples of accessories involving color selection.
- E. Samples for Verification: For each type of vertical louver blind.
 - 1. Vane: Not less than 12 inches long.
 - a. Fabric: 3-1/2 inches wide from dye lot used for the Work. Mark top and face of material.
 - 2. Vertical Louver Blind: Full-size unit, not less than 36 inches wide by 36 inches long.
 - 3. Valance: Full-size unit, not less than 12 inches wide.
- F. Product Schedule: For vertical louver blinds. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For vertical louver blinds with polymer vanes that have been tested for compliance with NFPA 701 for tests performed by manufacturer and witnessed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For vertical louver blinds to include in maintenance manuals.

1.6 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. Vertical Louver Blinds: Full-size units equal to 5 percent of quantity installed for each size, color, texture, pattern, and finish indicated, but no fewer than **two** units.

2. Vanes: Furnish quantity of full-size units equal to 5 percent of quantity installed for each type, size, texture, pattern, and finish indicated, but no fewer than **two** units.

1.7 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 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.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver vertical louver blinds in factory packages, marked with manufacturer and product name, and location of installation using same designations indicated on Drawings.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install vertical louver blinds until construction and wet-work 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 vertical louver blinds 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. Source Limitations: Obtain vertical louver blinds from single source from single manufacturer.

2.2 VERTICAL LOUVER BLINDS, PVC VANES

- A. Manufacturers: Subject to compliance with requirements, provide products by the following
- B. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
 1. Hunter Douglas Contract.
 2. Levolor Contract; a Newell Rubbermaid company.
 3. Springs Window Fashions; SWFcontract.
- C. Vanes: Lead-free, UV-stabilized, integrally colored, opaque, permanently flexible, extruded PVC that will not crack or yellow; with not less than 3/8-inch overlap when vanes are rotated fully closed.
 1. Width: 3-1/2 inches .
 2. Profile: Flat .
 3. Flame-Resistance Rating: Comply with NFPA 701; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

4. Features:
 - a. Bottom chain.
- D. Headrail: Channel, formed steel or extruded aluminum with long edges returned or rolled and ends capped. Headrail encloses operating mechanisms including carrier-spacing mechanism that provides uniform vane spacing when blinds are traversed fully across headrail (closed).
 1. Manual Traverse Control: Cord.
 2. Manual Rotation Control: Nickel-plated, metal bead chain .
 3. Manual Control Locations: As indicated on Drawings.
 4. Draw and Stack: As indicated on Drawings.
 5. Stack Release: Permitting stacked vanes to be moved away from stacking position for access to glazed opening.
 6. Cord-Tensioner Mounting: Sill>.
- E. Carriers: Engineered plastic with gears to align and synchronize vane rotation and stems that allow vane removal and replacement. Lead carriers have self-lubricating wheels or elongated bearing surfaces; remaining carriers have self-lubricating wheels.
- F. Valance: Manufacturer's standard with vane insert .
- G. Mounting Brackets: With spacers and shims required for blind placement and alignment indicated.
 1. Type: **Wall**.
 2. Intermediate Support: Provide intermediate support brackets to produce support spacing recommended by blind manufacturer for weight and size of blind.
- H. Colors, Textures, and Patterns:
 1. Vanes: As selected by Architect from manufacturer's full range.
 2. Components: Provide materials exposed to view matching or coordinating with vanes unless otherwise indicated.

2.3 VERTICAL LOUVER BLIND FABRICATION

- A. Product Safety Standard: Fabricate vertical louver blinds to comply with WCMA A 100.1 including requirements for corded, flexible, looped devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to cover window and other openings as follows, measured at 74 deg F:
 1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which blind is installed less 1/4 inch per side or 1/2 inch total, plus or minus 1/8 inch . Length equal to head-to-sill or -floor dimension of opening in which blind is installed less 1/4 inch , plus or minus 1/8 inch .
 2. Outside of Jamb Installation: Width and length as indicated, with terminations between blinds of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
- C. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.
 1. Rotation-and-Traverse Mechanisms: With permanently lubricated moving parts.
- D. Installation Brackets: Designed for easy removal and reinstallation of blind, for supporting headrail[, **valance**,] and operating hardware and for bracket positions and blind mounting method indicated.

- E. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to brackets and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.
- F. Color-Coated Finish: For metal components exposed to view unless anodized or plated finish is indicated. Apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, 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 installation tolerances, operational clearances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install vertical louver blinds level and plumb, aligned and centered on openings, and aligned with adjacent units according to manufacturer's written instructions.
 - 1. Locate so exterior vane edges are not closer than 2 inches from interior faces of glass and not closer than 1-1/2 inches from interior faces of glazing frames through full operating ranges of blinds.
 - 2. Install mounting and intermediate brackets to prevent deflection of headrails.
 - 3. Install with clearances that prevent interference with adjacent blinds, adjacent construction, and operating hardware of glazed openings, other window treatments, and similar building components and furnishings.
- B. Electrical Connections: Connect motorized operators to building electrical system.

3.3 ADJUSTING

- A. Adjust vertical louver blinds to operate free of binding or malfunction through full operating ranges.

3.4 CLEANING AND PROTECTION

- A. Clean vertical louver blind 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 ensures that vertical louver blinds are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged vertical louver blinds 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 systems.

END OF SECTION **122116**

SECTION 142400 - HYDRAULIC ELEVATORS

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 hydraulic passenger elevators.
- B. Related Requirements:
 - 1. Section 015000 "Temporary Facilities and Controls" for temporary use of elevators for construction purposes.
 - 2. Section 033000 "Cast-in-Place Concrete" for setting sleeves, inserts, and anchoring devices in concrete.
 - 3. Section 051200 "Structural Steel Framing" for the following:
 - a. Attachment plates, angle brackets, and other preparation of structural steel for fastening guide-rail brackets.
 - b. Hoist beams.
 - c. Structural-steel shapes for subsills.
 - d. Cants in hoistways made from steel sheet.
 - 4. Section 271500 "Communications Horizontal Cabling" for telephone service for elevators.
 - 5. Section 283111 "Digital, Addressable Fire-Alarm System" for smoke detectors in elevator lobbies to initiate emergency recall operation and heat detectors in shafts and machine rooms to disconnect power from elevator equipment before sprinkler activation and for connection to elevator controllers.

1.3 DEFINITIONS

- A. Definitions in ASME A17.1/CSA B44 apply to work of this Section.
- B. CBC: California Building Code.

1.4 ACTION SUBMITTALS

- A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for car enclosures, hoistway entrances, and operation, control, and signal systems.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and large-scale details indicating service at each landing, machine room layout, coordination with building structure, relationships with other construction, and locations of equipment.
 - 2. Include large-scale layout of car-control station and standby power operation control panel.
 - 3. Indicate maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.
 - 4. Submit calculations for structural components of the elevator system as required by the Division of the State Architect (DSA). Drawings, details and calculations shall be certified by a California registered structural engineer.

- C. Samples for Initial Selection: For finishes involving color selection.
- D. Samples for Verification: For exposed car, hoistway door and frame, and signal equipment finishes; 3-inch-square Samples of sheet materials; and 4-inch lengths of running trim members.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Seismic Qualification Certificates: For elevator equipment, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room layout and dimensions, as shown on Drawings, and electrical service including standby power generator, as shown and specified, are adequate for elevator system being provided.
- D. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.
- B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.
 - 1. Coordinate required inspections and certifications.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Elevator manufacturer or an authorized representative who is trained and approved by manufacturer.
- B. Regulatory Requirements.
 - 1. General 11B-407.1
 - a. Elevators shall be passenger elevators as classified by ASME A17.1 and shall comply with 11B-407 and with ASME A17.1.
 - b. Elevator operation shall be automatic.
 - c. When the only elevators provided for use by the public and employees are combination passenger and freight elevators, they shall comply with 11B-407 and ASME A17.1.
 - 2. Elevator landing requirements: 11B-407.2 and 1007
 - a. Call controls: Where elevator call buttons or keypads are provided, they shall comply with 11B-407.2.1 and 11B-309.4.
 - 1) Height - Call buttons and keypads shall be located within one of the reach ranges specified in 11B-308, measured to the centerline of the highest operable part.
 - 2) Size and shape - Call buttons shall have square shoulders, be 3/4 inch minimum in the smallest dimension and shall be raised 1/8 inch plus or minus 1/32 inch above the surrounding surface. The buttons shall be activated by a mechanical motion that is detectable.

- 3) Clear floor or ground space - A clear floor or ground space complying with 11B-305 shall be provided at call controls.
- 4) Location - The call button that designates the up direction shall be located above the call button that designates the down direction.
- 5) Signals - Call buttons shall have visible signals that will activate when each call is registered and will extinguish when each call is answered. Call buttons shall be internally illuminated with a white light over the entire surface of the button.
- 6) Keypads - Keypads, where provided, shall be in a standard telephone keypad arrangement and shall comply with 11B-407.4.7.2.
- b. Hall signals: Hall signals, including in-car signals, shall comply with 11B-407.2.2
 - 1) Visible and audible signals - A visible and audible signal shall be provided at each hoistway entrance to indicate which car is answering a call and the car's direction of travel. Where in-car signals are provided, they shall be visible from the floor area adjacent to the hall call buttons.
 - 2) Visible signals: Visible signal fixtures shall be centered at 72 inches minimum above the finish floor or ground. The visible signal elements shall be a minimum 2 1/2 inches high by 2 1/2 inches wide. Signals shall be visible from the floor area adjacent to the hall call button.
 - 3) Audible signals: Audible signals shall sound once for the up direction and twice for the down direction, or shall have verbal annunciators that indicate the direction of elevator car travel. Audible signals shall have a frequency of 1500 Hz maximum. Verbal annunciators shall have a frequency of 300 Hz minimum and 3000 Hz maximum. The audible signal and verbal annunciator shall be 10 dB minimum above ambient, but shall not exceed 80 dB, measured at the hall call buttons.
- c. Hoistway signs: Signs at elevator hoistways shall comply with 11B-407.2.3.
 - 1) Floor designation: Floor designations complying with 11B-703.2 and 11B-703.4.1 shall be provided on both jambs of elevator hoistway entrances. Floor designations shall be provided in both raised characters and Braille. Raised characters shall be 2 inches high. A raised star, placed to the left of the floor designation, shall be provided on both jambs at the main entry level. The outside diameter of the star shall be 2 inches and all points shall be of equal length. Raised characters, including the star, shall be white on a black background. Braille complying with 11B-703.3 shall be placed below the corresponding raised characters and the star. The Braille translation for the star shall be ⠠MAIN⠠. Applied plates are acceptable if they are permanently fixed to the jamb.
- d.
3. Two-way communication: 1009.8
 - 1) Provide a two-way communication system with both audible and visible signals at the elevator landing on each accessible floor that is one or more stories above or below the story of exit discharge.
 - 2) Such systems are not required at elevator landings where they are provided within areas of refuge in accordance with 1009.6.3.
 - 3) Directions for the use of the two-way communication system and the instructions for summoning assistance via such system and written identification of the specific story, floor location and building address or other building identifier shall be posted adjacent to the two-way communication system. 1009.8.2

- b. Directional signage - 1009.10
- 4. Provide a directional signage complying with 11B-703.5 at elevator landings indicating the locations of the other means of egress and which are accessible means of egress.
Elevator door requirements: 11B-407.3
 - a. Type: Elevator doors shall be the horizontal sliding type. Car gates shall be prohibited.
 - b. Operation: Elevator hoistway and car doors shall open and close automatically.
 - c. Reopening device: Elevator doors shall be provided with a reopening device complying with 11B-407.3.3 that shall stop and reopen a car door and hoistway door automatically if the door becomes obstructed by an object or person.
 - d. Height: The device shall be activated by sensing an obstruction passing through the opening at 5 inches nominal and 29 inches nominal above the finish floor.
 - e. Contact: The device shall not require physical contact to be activated, although contact is permitted to occur before the door reverses.
 - f. Duration: Door reopening devices shall remain effective for 20 seconds minimum.
 - g. Door and signal timing: The minimum acceptable time from notification that a car is answering a call until the doors of that car start to close shall be calculated from the following equation:
 - h. $T = D/(1.5 \text{ ft/s})$ or $T = D/(457 \text{ mm/s}) = 5 \text{ seconds minimum where}$
 - i. T equals the total time in seconds and D equals the distance (in feet or millimeters) from the point in the lobby or corridor 60 inches directly in front of the farthest call button controlling that car to the centerline of its hoistway door.
 - j. Door delay: Elevator doors shall remain fully open in response to a car call for 5 seconds minimum.
 - k. Width: The width of elevator doors shall comply with Table 11B-407.4.1.
- 5. Elevator car requirements: 11B-407.4
 - a. Car dimensions: Inside dimensions of elevator cars and clear width of elevator doors shall comply with Table 407.4.1. Where elevators are provided in buildings four or more stories above, or four or more stories below, grade plane, not fewer than one elevator shall be provided for fire department emergency access to all floors (80" x 54" inside car dimensions or otherwise accommodate requirement) per 3002.4 and 3002.4.3a.
 - b. Floor surfaces: floor surfaces in elevator cars shall comply with 11B-302 and 11B-303.
 - c. Platform to hoistway clearance: The clearance between the car platform sill and the edge of any hoistway landing shall be 1 1/4 inches maximum.
 - d. Leveling: Each car shall be equipped with a self-leveling feature that will automatically bring and maintain the car at floor landings within a tolerance of 1/2 inch under rated loading to zero loading conditions.
 - e. Illumination: The level of illumination at the car controls, platform, car threshold and car landing sill shall be 5 foot candles minimum.
 - f. Elevator car controls: Where provided, they shall comply with 11B-407.4.6 and 11B-309.4.
 - 1) Location: Controls shall be located within one of the reach ranges specified in 11B-308.
 - 2) Buttons: Car control buttons with floor designations shall comply with the following:
 - a) Size and Shape: Buttons shall have square shoulders, be 3/4 inch minimum in the smallest dimension and be raised 1/8 inch plus or minus 1/32 inch above the surrounding surface.

- b) Arrangement: buttons shall be arranged with numbers in ascending order. When two or more columns of buttons are provided they shall read from left to right.
 - c) Illumination: Car control buttons shall be illuminated.
 - d) Operation: Car control buttons shall be activated by a mechanical motion that is detectable.
- 3) Keypads: Car control keypads shall be in a standard telephone keypad arrangement and shall comply with 11B-407.4.7.2.
- 4) Emergency controls: Emergency controls shall comply with 11B-407.4.6.4.
 - a) Height: Emergency control buttons shall have their centerlines 35 inches minimum above the finish floor.
 - b) Location: Emergency controls, including the emergency alarm, shall be grouped at the bottom of the panel.
- g. Designations and indicators of car controls: they shall comply with 11B-407.4.7.
 - 1) Buttons: Car control buttons shall comply with 11B-407.4.7.1.
 - a) Type: Control buttons shall be identified by raised characters or symbols, white on a black background, complying with 11B-703.2 and Braille complying with 11B-703.3.
 - b) Location: Raised characters or symbols and Braille designations shall be placed immediately to the left of the control button to which the designations apply.
 - c) Symbols: The control button for the emergency stop, alarm, door open, door close, main entry floor, and phone, shall be identified with raised symbols and Braille as shown in Table 11B-407.4.7.1.3.
 - d) Visible indicators: buttons with floor designations shall be provided with visible indicators to show that a call has been registered. The visible indication shall extinguish when the car arrives at the designated floor.
 - e) Button spacing: A minimum clear space of 3/8 inch or other suitable means of separation shall be provided between rows of control buttons.
 - 2) Keypads: Keypads shall be identified by characters complying with 11B-703.5 and shall be centered on the corresponding keypad button. The number five key shall have a single raised dot. The dot shall be 0.118 inch to 0.120 inch base diameter and in other aspects comply with Table 11B-703.3.1.
- h. Car position indicators: Audible and visible car position indicators shall be provided in elevator cars.
 - 1) Visible indicators: Visible indicators shall comply with 11B-407.4.8.1.
 - a) Size: Characters shall be 1/2 inch high minimum.
 - b) Location: Indicators shall be located above the car control panel or above the door.
 - c) Floor arrival: As the car passes a floor and when a car stops at a floor served by the elevator, the corresponding character shall illuminate.
 - 2) Audible indicators: Audible indicators shall comply with 11B-407.4.8.2.
 - a) Signal type: The signal shall be an automatic verbal annunciator which announces the floor at which the car is about to stop.
 - b) Signal level: The verbal annunciator shall be 10 dB minimum above ambient, but shall not exceed 80 dB, measured at the annunciator.

- c) Frequency: The verbal annunciator shall have a frequency of 300 HZ minimum to 3000 HZ maximum.
 - i. Emergency communication: Emergency two-way communication systems shall comply with 11B-308. Raised symbols or characters, white on a black background, and Braille shall be provided adjacent to the device and shall comply with 11B-703.2 and 11B-703.3. Emergency two-way communication systems between the elevator and a point outside the hoistway shall comply with ASME A17.1.
 - j. Support rail: Support rails shall be provided on at least one wall of the car.
 - 1) Location: Clearance between support rails and adjacent surfaces shall be 1 1/2 inches minimum. Top of support rails shall be 31 inches minimum to 33 inches maximum above the floor of the car. The ends of the support rail shall be 6 inches maximum from adjacent walls
- 1.8 .
- 1) Surfaces: Support rails shall be smooth and any surface adjacent to them shall be free of sharp or abrasive elements.
 - 2) Structural strength: Allowable stresses shall not be exceeded for materials used when a vertical or horizontal force of 250 pounds is applied at any point on the support rail, fastener, mounting device, or supporting structure

B. .

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials, components and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

1.10 COORDINATION

- A. Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete or masonry for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.
- B. Coordinate locations and dimensions of other work specified in other Sections relating to hydraulic elevators including pit ladders; sumps and floor drains in pits; entrance subsills; electrical service; and electrical outlets, lights, and switches in hoistways, pits, and machine rooms.
- C. Do not begin installation of guide rails or brackets until submittals have been approved by DSA.
- D. Contractor to coordinate selected elevator requirements for connections with all provided utilities. Revisions to electrical feed requirements due to up-sizing or downsizing of motors will be at the contractor's expense.
- E. Revisions to elevator equipment due to space limitations in equipment rooms as shown on the approved plans and bid documents will be provided at the expense of the contractor.
- F. Hydraulic lines shall be concealed or routed through concealed locations unless otherwise noted on the plans. Hydraulic line routing to be review and approved by the Architect. Revisions to equipment based upon contractor-proposed revised routing lines in order to remain in compliance with the drawings and specifications will not be allowable grounds for a change order.

1.11 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
 - 2. Warranty Period: one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 HYDRAULIC ELEVATOR MANUFACTURERS

- A. Manufacturers:
 - 1. Otis Elevator Co.
 - 2. Schindler Elevator Corp.
 - 3. ThyssenKrupp Elevator.
 - 4. Or equal.
- B. Source Limitations: Obtain elevators, from single manufacturer.
 - 1. Major elevator components, including pump-and-tank units, twin post holeless jack assemblies, controllers, signal fixtures, door operators, car frames, cars, and entrances, shall be manufactured by single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements:
 - 1. Comply with ASME A17.1/CSA B44.
 - 2. Comply with California Code of Regulations (CCR) Title 8, Elevator Safety Orders of the State of California Division of Industrial Safety.
- B. Accessibility Requirements: Comply with Section 407 in the United States Access Board's ADA-ABA Accessibility Guidelines and the CBC.
- C. Seismic Performance: Elevator system shall withstand the effects of earthquake motions determined according to the CBC and shall comply with elevator safety requirements for seismic risk Zone 4 in ASME A17.1/CSA B44.
 - 1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."
 - 2. Affected peak velocity acceleration (Av) for Project's location is greater than or equal to 0.20 (seismic risk Zones 3 and 4).
 - 3. Provide earthquake equipment required by ASME A17.1/CSA B44.
 - 4. Provide seismic switch required by ASCE/SEI 7.
 - 5. Design earthquake spectral response acceleration short period (Sds) for Project is 1.180
 - 6. Project's Seismic Design Category: D.
 - 7. Elevator Component Importance Factor: 1.0.

2.3 ELEVATORS

- A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturers' standard components shall be used, as included in standard elevator systems and as required for complete system.
- B. Elevator Description:
 - 1. Elevator Number(s): As shown on drawings
 - 2. Type: Twin Post Holeless Hydraulic.
 - 3. Rated Load: 3500 lb.
 - 4. Rated Speed: 100 fpm.
 - 5. Operation System: Selective-collective automatic operation.
 - 6. Auxiliary Operations:
 - a. Battery-powered lowering.
 - b. Automatic dispatching of loaded car.
 - c. Nuisance call cancel.
 - 7. Security Features: Keyswitch operation.
 - 8. Car Enclosures:
 - a. Inside Width: 80 inches from side wall to side wall.
 - b. Inside Depth: Not less than 65-1/2 inches from back wall to front wall (return panels).
 - c. Inside Height: 96 inches with ceiling removed.
 - d. Front Walls (Return Panels): Satin stainless steel, No. 4 finish with integral car door frames.
 - e. Car Fixtures: Satin stainless steel, No. 4 finish.
 - f. Side and Rear Wall Panels: Satin stainless steel, No. 4 finish.
 - g. Reveals: Satin stainless steel, No. 4 finish.
 - h. Door Faces (Interior): Satin stainless steel, No. 4 finish.
 - i. Door Sills: Aluminum, mill finish.
 - j. Ceiling: LED downlight
 - k. Handrails: 1/2 by 2 inches rectangular satin stainless steel, No. 4 finish at sides and rear of car.
 - l. Floor prepared to receive resilient flooring specified in Section 096519 "Resilient Tile Flooring".
 - 9. Hoistway Entrances:
 - a. Width: 42 inches.
 - b. Height: 84 inches.
 - c. Type: Single-speed side sliding.
 - d. Frames: Satin stainless steel, No. 4 finish.
 - e. Doors: Satin stainless steel, No. 4 finish.
 - f. Sills: Aluminum, mill finish.
 - 10. Hall Fixtures: Satin stainless steel, No. 4 finish.
 - 11. Additional Requirements:
 - a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, No. 4 finish.

2.4 SYSTEMS AND COMPONENTS

- A. Pump Units: Positive-displacement type with a maximum of 10 percent variation between no load and full load and with minimum pulsations.
 - 1. Pump shall be submersible type with submersible squirrel-cage induction motor, and shall be suspended inside oil tank from vibration isolation mounts

2. Motor shall have variable-voltage, variable-frequency control.
- B. Hydraulic Silencers: System shall have hydraulic silencer containing pulsation-absorbing material in blowout-proof housing at pump unit.
- C. Piping: Size, type, and weight of piping as recommended by elevator manufacturer, with flexible connectors to minimize sound and vibration transmissions from power unit.
 1. Cylinder units shall be connected with dielectric couplings.
 2. Casing for Underground Piping: Schedule 40 PVC pipe complying with ASTM D 1785, joined with PVC fittings complying with ASTM D 2466 and solvent cement complying with ASTM D 2564.
- D. Hydraulic Fluid: Elevator manufacturer's standard fire-resistant fluid with additives as needed to prevent oxidation of fluid, corrosion of cylinder and other components, and other adverse effects.
- E. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work. Device installation is specified in another Section.
- F. Protective Cylinder Casing: PVC or HDPE pipe casing complying with ASME A17.1/CSA B44, of sufficient size to provide not less than 1-inch clearance from cylinder and extending above pit floor. Casing shall have means of monitoring effectiveness to comply with ASME A17.1/CSA B44.
- G. Car Frame and Platform: Welded steel units.
- H. Guides: Roller guides; polymer-coated, nonlubricated sliding guides; or sliding guides with guide-rail lubricators. Provide guides at top and bottom of car and counterweight frames.
- I. Pit Ladder: Prefabricated aluminum ladder as shown on drawings.

2.5 OPERATION SYSTEMS

- A. General: Provide manufacturer's standard microprocessor operation system as required to provide type of operation indicated.
- B. Auxiliary Operations: In addition to primary operation system features, provide the following operational features for elevators where indicated:
 1. Single-Car Battery-Powered Lowering: When power fails, car is lowered to the lowest floor, opens its doors, and shuts down. System includes rechargeable battery and automatic recharging system.
 2. Automatic Dispatching of Loaded Car: When car load exceeds 80 percent of rated capacity, doors start closing.
 3. Nuisance Call Cancel: When car calls exceed a preset number while car load is less than a predetermined weight, all car calls are canceled. Preset number of calls and predetermined weight can be adjusted.
- C. Security Features: Provide the following security features, where indicated. Security features shall not affect emergency firefighters' service.
 1. Keyswitch Operation: Push buttons are activated and deactivated by security keyswitches at hall push-button stations. Key is removable in either position.

2.6 DOOR REOPENING DEVICES

- A. Infrared Array: Provide door reopening device with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more light beams shall cause doors to stop and reopen.
- B. Nudging Feature: After car doors are prevented from closing for predetermined adjustable time, through activating door reopening device, a loud buzzer shall sound and doors shall begin to close at reduced kinetic energy.

2.7 CAR ENCLOSURES

- A. General: Provide steel-framed car enclosures with nonremovable wall panels, with removable car roof, access doors, power door operators, and ventilation.
 - 1. Provide standard railings complying with ASME A17.1/CSA B44 on car tops where required by ASME A17.1/CSA B44.
- B. Materials and Finishes: Manufacturer's standards, but not less than the following:
 - 1. Subfloor: Exterior, underlayment grade plywood, not less than 5/8-inch nominal thickness.
 - 2. Floor Finish: Specified in 096519 Resilient Tile Flooring• .
 - 3. Stainless-Steel Wall Panels: Flush, hollow-metal construction; fabricated from stainless-steel sheet.
 - 4. Fabricate car with recesses and cutouts for signal equipment.
 - 5. Fabricate car door frame integrally with front wall of car.
 - 6. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet.
 - 7. Sight Guards: Provide sight guards on car doors.
 - 8. Sills: Extruded or machined metal, with grooved surface, 1/4 inch thick.
 - 9. Ceiling: LED downlight light fixtures and ceiling panels of No. 4 stainless steel.
 - 10. Handrails: Manufacturer's standard handrails, of shape, metal, and finish indicated.

2.8 HOISTWAY ENTRANCES

- A. Hoistway Entrance Assemblies: Manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Frame size and profile shall accommodate hoistway wall construction.
 - 1. Where gypsum board wall construction is indicated, frames shall be self-supporting with reinforced head sections.
- B. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing at as close-to-neutral pressure as possible according to NFPA 252 or UL 10B.
 - 1. Fire-Protection Rating: 1 hour.
- C. Materials and Fabrication: Manufacturer's standards, but not less than the following:
 - 1. Stainless-Steel Frames: Formed from stainless-steel sheet.
 - 2. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet.
 - 3. Sight Guards: Provide sight guards on doors matching door edges.
 - 4. Sills: Extruded metal, with grooved surface, 1/4 inch thick.
 - 5. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M.

2.9 SIGNAL EQUIPMENT

- A. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Provide vandal-resistant buttons and lighted elements illuminated with LEDs.
- B. Car-Control Stations: Provide manufacturer's standard recessed car-control stations. Mount in return panel adjacent to car door unless otherwise indicated.
 - 1. Mark buttons and switches for required use or function. Use both tactile symbols and Braille.
 - 2. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.
 - 3. Mount controls at heights complying with the U.S. Architectural & Transportation Barriers Compliance Board's Americans with Disabilities Act (ADA), Accessibility Guidelines (ADAAG), and the CBC.
- C. Emergency Communication System: Provide system that complies with ASME A17.1 and the U.S. Architectural and Transportation Barriers Compliance Board's Americans with Disabilities Act (ADA), Accessibility Guidelines (ADAAG), and the CBC. System shall provide two-way voice communication, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System shall be contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.
- D. Car Position Indicator: Provide illuminated, digital-type car position indicator, located above car door or above car-control station. Also, provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served. Include travel direction arrows if not provided in car-control station.
- E. Hall Push-Button Stations: Provide one hall push-button station at each landing.
 - 1. Provide units with flat faceplate for mounting with body of unit recessed in wall.
 - 2. Equip units with buttons for calling elevator and for indicating applicable direction of travel.
- F. Hall Lanterns: Units with illuminated arrows; but provide single arrow at terminal landings. Provide the following:
 - 1. Manufacturer's standard wall-mounted units, for mounting above entrance frames.
 - 2. Units mounted in both jambs of entrance frame.
- G. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.
- H. Hall Position Indicators: Provide illuminated, digital-display-type position indicators, located above hoistway entrance at ground floor.
 - 1. Provide units with flat faceplate for mounting and with body of unit recessed in wall.
 - 2. Integrate ground-floor hall lanterns with hall position indicators.
- I. Emergency Pictorial Signs: Fabricate from materials matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station unless otherwise indicated.

2.10 FINISH MATERIALS

- A. General: Provide the following materials for exposed parts of elevator car enclosures, car doors, hoistway entrance doors and frames, and signal equipment as indicated.
- B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, commercial steel, Type B, exposed, matte finish.
- C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, commercial steel, Type B, pickled.
- D. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.
- E. Satin Stainless Steel: ASTM A 666, Type 304, with No. 4, directional satin finish.
- F. Stainless-Steel Bars: ASTM A 276, Type 304.
- G. Aluminum Extrusions: ASTM B 221, Alloy 6063.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Verify critical dimensions and examine supporting structure and other conditions under which elevator work is to be installed.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install twin post holeless jack units plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor. Seal between protective casing and pit floor with 4 inches of nonshrink, nonmetallic grout.
- B. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS workmanship and welding operator qualification standards.
- C. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.
- D. Install piping above the floor, where possible. Where not possible, install underground piping in Schedule 40 PVC pipe casing assembled with solvent-cement fittings.
 - 1. Excavate for piping and backfill encased piping according to applicable requirements in Section 312000 "Earth Moving."
- E. Lubricate operating parts of systems as recommended by manufacturers.
- F. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay installation of sills and frames until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.

- G. Leveling Tolerance: 1/4 inch, up or down, regardless of load and travel direction.
- H. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.
- I. Locate hall signal equipment for elevators as follows, unless otherwise indicated:
 - 1. Mount hall lanterns at a minimum of 72 inches above finished floor.

3.3 FIELD QUALITY CONTROL

- A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.
- B. Advise Project Inspector in advance of dates and times that tests are to be performed on elevators.

3.4 PROTECTION

- A. Temporary Use: Comply with the following requirements for elevator used for construction purposes:
 - 1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
 - 2. Provide strippable protective film on entrance and car doors and frames.
 - 3. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.
 - 4. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
 - 5. Do not load elevators beyond their rated weight capacity.
 - 6. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleanup, and adjustment as necessary for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
 - 7. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train District's maintenance personnel to operate elevator(s). Review emergency provisions, including emergency access and procedures to be followed at time of operational failure and other building emergencies.
- B. Check operation of elevator with District's personnel present before date of Substantial Completion. Determine that operation systems and devices are functioning properly.

3.6 MAINTENANCE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include twelve months' full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 - 1. Perform maintenance during normal working hours.

2. Perform emergency callback service during normal working hours with response time of two hours or less.
3. Include 24-hour-per-day, 7-day-per-week emergency callback service with response time of two hours or less.

END OF SECTION 142400

SECTION 21 11 19 PRIVATE FIRE MAIN SYSTEM

PART 1 - GENERAL

1.01.1 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 to lateral(s) at property line(s), as shown on civil plans.
 - 2. Approved backflow prevention assembly or assemblies.
 - 3. All 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 1313
- C. Fire Alarm System Section 28 30 01
- D. Utilities Division 33

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, 2019 edition.
 - 2. California Fire Code, 2019 edition.
 - 3. State of California, Division of the State Architect.
 - 4. Murrieta Fire Department requirements.
 - 5. Western Municipal Water District.
 - 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. Western Municipal Water District Standard Specifications for new construction, current edition.
 - b. Riverside 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. Western Municipal Water District Standard Drawings.

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

1.1 DESCRIPTION

- A. 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 areas 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.

1.2 RELATED WORK IN OTHER SECTIONS

- | | | |
|----|--------------------------------|------------------|
| A. | General Requirements | Division 01 |
| B. | Exterior Painting | Section 09 9113 |
| C. | Interior Painting | Section 09 9123 |
| D. | Private Fire Main System | Section 21 1119 |
| E. | Sanitary Waste and Vent Piping | Section 22 1316 |
| F. | Fire Alarm System | Section 28 30 01 |
| G. | Utilities | Division 33 |

1.3 QUALITY ASSURANCE

Murrieta Elementary School New CR Bldg
Murrieta Valley Unified School District
BakerNowicki Design Studio #18009-00

Wet-Pipe Fire Sprinklers Systems - Page Count
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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.

1.4 REFERENCES

A. In addition to complying with all pertinent standards, codes and regulations, comply with all requirements of:

1. California Building Code, 2019 edition.
2. California Fire Code, 2019 edition.
3. State of California, Division of the State Architect.
4. Murrieta Fire Department requirements.
5. Western Municipal Water District.
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.

1.5 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.

1.6 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 Architect and obtain necessary information to design fire sprinkler system 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.

PART 2 - DESIGN AND MATERIALS

2.1 GENERAL DESIGN CRITERIA

- A. Coverage and Scope
 1. Kitchen, food preparation, storage, custodial and utility 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.

2.2 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.

2.3 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
2. Provide recessed standard spray pendent, with white polyester finish and matching escutcheon.
 3. Listed corrosion-resistant sprinklers shall be installed at exterior areas, with white polyester or Teflon finish and matching escutcheon.
- B. 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.
- C. 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 UON.
 - d. Sidewall sprinkler at the bottom of the elevator hoistway shall have a temperature rating of 155° F.

2.4 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.

2.5 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.

2.6 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.

2.7 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.

2.8 PROTECTION OF SPRINKLERS

- A. Provide UL/FM listed guards for sprinkler heads located in areas susceptible to mechanical damage.

2.9 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 2.14B.

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.
3. Butterfly valve is an acceptable control valve.
4. Pressure relief valve are acceptable when required by NFPA 13.

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.
3. 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

3.1 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.

3.2 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.

3.3 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.

3.4 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.

3.5 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.
4. Submit two copies of guarantee per Section 01 78 39.
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 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Stack-sleeve fittings.
 - 3. Sleeve-seal systems.
 - 4. Sleeve-seal fittings.
 - 5. Grout.
 - 6. Silicone sealants.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advance Products & Systems, Inc.
 - 2. CALPICO, Inc.
 - 3. GPT; an EnPro Industries company.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop collar.
- C. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, with plain ends and integral welded waterstop collar.
- D. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- E. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.
- F. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

- G. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Jay R. Smith Mfg. Co.
 - 2. Zurn Industries, LLC.
- B. Description: Manufactured, galvanized cast-iron sleeve with integral clamping flange for use in waterproof floors and roofs. Include clamping ring, bolts, and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advance Products & Systems, Inc.
 - 2. CALPICO, Inc.
 - 3. GPT; an EnPro Industries company.
 - 4. Metraflex Company (The).
 - 5. Proco Products, Inc.
- B. Description:
 - 1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 - 2. Designed to form a hydrostatic seal of 20 psig minimum.
 - 3. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 4. Pressure Plates: Carbon steel.
 - 5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B 633 of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advance Products & Systems, Inc.
 - 2. CALPICO, Inc.
 - 3. GPT; an EnPro Industries company.
 - 4. Metraflex Company (The).

5. Proco Products, Inc.

- B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.
- C. Plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

- A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.6 SILICONE SEALANTS

- A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C 920, Type S, Grade NS, Class 25, Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; Dow Corning 758 Silicone Weather Barrier Sealant.
 - b. Schnee-Morehead, Inc., an ITW company; SM5731 Poly-Glaze Plus.
 - c. Sherwin-Williams Company (The); White Lightning Silicone Ultra All Purpose Sealant.
 - 2. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
 - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
 - 2. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 - 3. Using grout or silicone sealant, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.
- E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
 - 1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - 2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
 - 3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
 - 4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 5. Use silicone sealant to seal the space around outside of stack-sleeve fittings.

- B. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Use grout or silicone sealant to seal the space around outside of sleeve-seal fittings.

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
- B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.6 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves.

2. Exterior Concrete Walls below Grade:
 - a. Piping Smaller Than NPS 6: Steel pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
3. Concrete Slabs-on-Grade:
 - a. Piping Smaller Than NPS 6: Sleeve-seal fittings.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
4. Concrete Slabs above Grade:
 - a. Piping Smaller Than NPS 6: Steel pipe sleeves .
5. Interior Partitions:
 - a. Piping Smaller Than NPS 6: Steel pipe sleeves.

END OF SECTION 220517

SECTION 220518 - ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Escutcheons.
 - 2. Floor plates.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. BrassCraft Manufacturing Co.; a Masco company.
 - 2. Dearborn Brass.
 - 3. Jones Stephens Corp.
 - 4. Keeney Manufacturing Company (The).
 - 5. Mid-America Fittings, Inc.
 - 6. ProFlo; a Ferguson Enterprises, Inc. brand.

2.2 ESCUTCHEONS

- A. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-Piece, Stainless-Steel Type: With polished stainless-steel finish.
- C. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

- D. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel with polished, chrome-plated finish and spring-clip fasteners.
- E. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.
- F. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed and exposed-rivet hinge; and spring-clip fasteners.

2.3 FLOOR PLATES

- A. Split Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.
 - 1. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
 - b. Chrome-Plated Piping: One-piece steel with polished, chrome-plated finish.
 - c. Insulated Piping: One-piece steel with polished, chrome-plated finish.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
 - f. Bare Piping in Unfinished Service Spaces: One-piece steel with polished, chrome-plated finish.
 - g. Bare Piping in Equipment Rooms: One-piece steel with polished, chrome-plated finish.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. New Piping : One-piece, floor plate.
 - 2. Existing Piping: Split floor plate.

END OF SECTION 220518

SECTION 220523.12 - BALL VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Brass ball valves.
 - 2. Bronze ball valves.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of valve.
 - 1. Certification that products comply with NSF 61 and NSF 372.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, and soldered ends.
 - 3. Set ball valves open to minimize exposure of functional surfaces.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B1.20.1 for threads for threaded end valves.
 - 2. ASME B16.1 for flanges on iron valves.
 - 3. ASME B16.5 for flanges on steel valves.
 - 4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 5. ASME B16.18 for solder-joint connections.
 - 6. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 and NSF 372 for valve materials for potable-water service.
- D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as upstream piping unless otherwise indicated.
- G. Valves in Insulated Piping:
 - 1. Include 2-inch stem extensions.
 - 2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
 - 3. Memory stops that are fully adjustable after insulation is applied.

2.2 BRASS BALL VALVES

- A. Brass Ball Valves, Two-Piece with Full Port and Brass Trim, Threaded or Soldered Ends:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Valve, Inc.
 - b. Apollo Flow Controls; Conbraco Industries, Inc.
 - c. Crane; Crane Energy Flow Solutions.
 - d. DynaQuip Controls.
 - e. Elkhart Products Corporation.
 - f. FNW; Ferguson Enterprises, Inc.

- g. Hammond Valve.
- h. Jomar Valve.
- i. KITZ Corporation.
- j. Legend Valve & Fitting, Inc.
- k. Marwin Valve; Richards Industries.
- l. Milwaukee Valve Company.
- m. NIBCO INC.
- n. Red White Valve Corp.
- o. Stockham; Crane Energy Flow Solutions.
- p. WATTS.

2. Description:

- a. Standard: MSS SP-110 or MSS SP-145.
- b. CWP Rating: 600 psig.
- c. Body Design: Two piece.
- d. Body Material: Forged brass.
- e. Ends: Threaded and soldered.
- f. Seats: PTFE.
- g. Stem: Brass.
- h. Ball: Chrome-plated brass.
- i. Port: Full.

B. Brass Ball Valves, Two-Piece with Full Port and Stainless-Steel Trim, Threaded or Soldered Ends:

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

- a. Apollo Flow Controls; Conbraco Industries, Inc.
- b. Hammond Valve.
- c. Jomar Valve.
- d. KITZ Corporation.
- e. Marwin Valve; Richards Industries.
- f. Milwaukee Valve Company.
- g. NIBCO INC.

2. Description:

- a. Standard: MSS SP-110 or MSS SP-145.
- b. CWP Rating: 600 psig.
- c. Body Design: Two piece.
- d. Body Material: Forged brass.
- e. Ends: Threaded and soldered.
- f. Seats: PTFE.
- g. Stem: Stainless steel.
- h. Ball: Stainless steel, vented.
- i. Port: Full.

2.3 BRONZE BALL VALVES

A. Bronze Ball Valves, Two-Piece with Full Port, and Bronze or Brass Trim, Threaded or Soldered Ends:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo Flow Controls; Conbraco Industries, Inc.
 - b. Crane; Crane Energy Flow Solutions.
 - c. FNW; Ferguson Enterprises, Inc.
 - d. Hammond Valve.
 - e. Lance Valves.
 - f. Milwaukee Valve Company.
 - g. NIBCO INC.
 - h. WATTS.
 - i. Zurn Industries, LLC.
2. Description:
 - a. Standard: MSS SP-110 or MSS-145.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Bronze.
 - e. Ends: Threaded and soldered.
 - f. Seats: PTFE.
 - g. Stem: Bronze or brass.
 - h. Ball: Chrome-plated brass.
 - i. Port: Full.

B. Bronze Ball Valves, Two-Piece with Full Port and Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo Flow Controls; Conbraco Industries, Inc.
 - b. Crane; Crane Energy Flow Solutions.
 - c. FNW; Ferguson Enterprises, Inc.
 - d. Hammond Valve.
 - e. Lance Valves.
 - f. Milwaukee Valve Company.
 - g. NIBCO INC.
 - h. WATTS.
2. Description:
 - a. Standard: MSS SP-110 or MSS-145.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Bronze.

- e. Ends: Threaded or soldered.
- f. Seats: PTFE.
- g. Stem: Stainless steel.
- h. Ball: Stainless steel, vented.
- i. Port: Full.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install valve tags. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.
- B. Select valves with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option or press-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Steel Piping, NPS 2 and Smaller: Threaded ends.
4. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

3.4 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Brass ball valves, two-piece with full port and brass or stainless steel trim. Provide with threaded or solder -joint ends.
2. Bronze ball valves, two-piece with full port and bronze or brass trim. Provide with threaded or solder -joint ends.
3. Bronze ball valves, two-piece with regular port and bronze or stainless-steel trim.

END OF SECTION 220523.12

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Thermal hanger-shield inserts.
 - 4. Fastener systems.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze pipe hangers.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.
- B. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - 3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

2.2 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
 - 3. Nonmetallic Coatings: Plastic coated or epoxy powder coated.
 - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel stainless steel.
- B. Copper Pipe and Tube Hangers:
 - 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
 - 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.3 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 THERMAL HANGER-SHIELD INSERTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Carpenter & Paterson, Inc.
 - 2. Clement Support Services.
 - 3. ERICO International Corporation.
 - 4. National Pipe Hanger Corporation.
 - 5. Pipe Shields Inc.
 - 6. Piping Technology & Products, Inc.
 - 7. Rilco Manufacturing Co., Inc.
 - 8. Value Engineered Products, Inc.
- B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

- A. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. B-line, an Eaton business.
 - b. Empire Tool and Manufacturing Co., Inc.
 - c. Hilti, Inc.
 - d. ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - e. MKT Fastening, LLC.
 - 2. Indoor Applications: Zinc-coated steel.
 - 3. Outdoor Applications: Stainless steel.

2.6 MATERIALS

- A. Aluminum: ASTM B 221.
- B. Carbon Steel: ASTM A 1011/A 1011M.

- C. Structural Steel: ASTM A 36/A 36M carbon-steel plates, shapes, and bars; black and galvanized.
- D. Stainless Steel: ASTM A 240/A 240M.
- E. Grout: ASTM C 1107/C 1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:
 - 1. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

- E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- F. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- G. Install lateral bracing with pipe hangers and supports to prevent swaying.
- H. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts.
- I. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- K. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating Below Ambient Air Temperature: Use thermal hanger-shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.

5. Thermal Hanger Shields: Install with insulation of same thickness as piping insulation.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded, shop-painted areas on miscellaneous metal are specified in Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A 780/A 780M.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

- B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- F. Use stainless-steel pipe hangers and fiberglass pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal hanger-shield inserts for insulated piping and tubing.
- J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
 - 5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
 - 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
 - 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
 - 11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
 - 12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.

13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
 17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction occurs.
 18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction occurs.
 19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction occurs but vertical adjustment is unnecessary.
 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction occurs and vertical adjustment is unnecessary.
 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation, in addition to expansion and contraction, is required.
- K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment of up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11 split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.
- O. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- P. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.
- Q. Use pipe-positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 220548 - VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Seismic-restraint accessories.

1.3 DEFINITIONS

- A. IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.
- C. OSHPD: Office of Statewide Health Planning & Development (for the State of California).

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:
 - 1. Site Class as Defined in the IBC: **D**.
 - 2. Assigned Seismic Use Group or Building Category as Defined in the IBC: **III**.
 - a. Component Importance Factor: **1.0**.
 - b. Component Response Modification Factor: Based on Table 13.6-1 in ASCE 7-16.
 - c. Component Amplification Factor: Based on Table 13.6-1 in ASCE 7-16.
 - 3. Design Spectral Response Acceleration at Short Periods (0.2 Second): **1.347**.
 - 4. Design Spectral Response Acceleration at 1.0-Second Period: **0.812**.
 - 5. Rated strengths, features, and applications shall be as defined in reports by by an agency acceptable to authorities having jurisdiction.

- a. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least 3 for concrete and 1 for all others, times the maximum seismic forces to which they are subjected.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."
- B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
- C. Comply with requirements in Section 077200 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
- D. Equipment Restraints:
 - 1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds .

2. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- E. Piping Restraints:
1. Comply with requirements in MSS SP-127.
 2. Space lateral supports a maximum of o.c., and longitudinal supports a maximum of o.c.
 3. Brace a change of direction longer than .
- F. Install cables so they do not bend across edges of adjacent equipment or building structure.
- G. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- H. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- I. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- J. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- K. Drilled-in Anchors:
1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 5. Set anchors to manufacturer's recommended torque, using a torque wrench.
 6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 221116 "Domestic Water Piping" for piping flexible connections.

3.5 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

END OF SECTION 220548

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Pipe labels.
- 2. Stencils.
- 3. Valve tags.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Valve numbering scheme.
- D. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 PIPE LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Actioncraft Products, Inc.
 - 2. Brady Corporation.
 - 3. Brimar Industries, Inc.
 - 4. Carlton Industries, LP.
 - 5. Champion America.
 - 6. Craftmark Identification Systems.
 - 7. emedco.
 - 8. Kolbi Pipe Marker Co.
 - 9. LEM Products Inc.

10. Marking Services Inc.
 11. Seton Identification Products.
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
 - C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
 - D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
 - E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
 1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 2. Lettering Size: Size letters according to ASME A13.1 for piping.

2.2 STENCILS

- A. Stencils for Piping:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brimar Industries, Inc.
 - b. Carlton Industries, LP.
 - c. Champion America.
 - d. Craftmark Identification Systems.
 - e. Kolbi Pipe Marker Co.
 - f. Marking Services Inc.
 2. Lettering Size: Size letters according to ASME A13.1 for piping.
 3. Stencil Material: Brass.
 4. Stencil Paint: Exterior, gloss, acrylic enamel in colors complying with recommendations in ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.
 5. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.

2.3 VALVE TAGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Actioncraft Products, Inc.

2. Brady Corporation.
 3. Brimar Industries, Inc.
 4. Carlton Industries, LP.
 5. Champion America.
 6. Craftmark Identification Systems.
 7. emedco.
 8. Kolbi Pipe Marker Co.
 9. LEM Products Inc.
 10. Marking Services Inc.
 11. Seton Identification Products.
- B. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 2. Fasteners: Brass wire-link chain or beaded chain or S-hook.
- C. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 PIPE LABEL INSTALLATION

- A. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.
 - 1. Identification Paint: Use for contrasting background.
 - 2. Stencil Paint: Use for pipe marking.
- B. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
- D. Pipe Label Color Schedule:
 - 1. Domestic Water Piping
 - a. Background: Safety green.
 - b. Letter Colors: White.

3.4 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
 - 1. Valve-Tag Size and Shape:
 - a. Cold Water: 1-1/2 inches, round.
 - b. Hot Water: 1-1/2 inches, round.

2. Valve-Tag Colors:
 - a. Cold Water: Natural.
 - b. Hot Water: Natural.
3. Letter Colors:
 - a. Cold Water: White.
 - b. Hot Water: White.

END OF SECTION 220553

SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes insulating the following plumbing piping services:
 - 1. Domestic cold-water piping.
 - 2. Domestic hot-water piping.
 - 3. Roof drains and rainwater leaders.
 - 4. Supplies and drains for handicap-accessible lavatories and sinks.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less and smoke-developed index of 150 or less.
- C. Comply with the following applicable standards and other requirements specified for miscellaneous components:
 - 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come into contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable in accordance with ASTM C795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Mineral-Fiber, Preformed Pipe: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C547.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville; a Berkshire Hathaway company.

- b. Knauf Insulation.
 - c. Owens Corning.
2. Preformed Pipe Insulation: Type I, Grade A, without factory-applied jacket with factory-applied ASJ with factory-applied ASJ-SSL.
 3. 850 deg F.
 4. Factory fabricate shapes in accordance with ASTM C450 and ASTM C585.
 5. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C195.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ramco Insulation, Inc.
 - b. Or Equal.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Foster Brand; H. B. Fuller Construction Products.
2. Adhesive: As recommended by mineral fiber manufacturer and with a VOC content of 80 g/L or less.
3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
4. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
5. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

6. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit or 33 mcg/cu. m and that of acetaldehyde shall not exceed 9 mcg/cu. m.
- C. ASJ Adhesive and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A, for bonding insulation jacket lap seams and joints.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Foster Brand; H. B. Fuller Construction Products.
 2. Adhesives shall have a VOC content of 80 g/L or less.
 3. Adhesives and sealants shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 4. Adhesives and sealants shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 5. Adhesives and sealants shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 6. Adhesives and sealants shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.

2.4 MASTICS AND COATINGS

- A. Materials shall be compatible with insulation materials, jackets, and substrates.
1. Mastics: As recommended by insulation manufacturer and with a VOC content of 50 g/L or less.
 2. Mastics shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

3. Mastics shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 4. Mastics shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 5. Mastics shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.
- B. Vapor-Retarder Mastic, Water Based: Suitable for indoor use on below-ambient services.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Foster Brand; H. B. Fuller Construction Products.
 - c. Knauf Insulation.
 - d. Vimasco Corporation.
 2. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
 3. Service Temperature Range: 0 to plus 180 deg F Minus 20 to plus 180 deg F.
 4. Comply with MIL-PRF-19565C, Type II, for permeance requirements.
 5. Color: White Insert color.
- C. Vapor-Retarder Mastic, Solvent Based, Indoor Use: Suitable for indoor use on below-ambient services.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Foster Brand; H. B. Fuller Construction Products.
 2. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
 3. Service Temperature Range: 0 to 180 deg F.
 4. Color: White Insert color.
- D. Vapor-Retarder Mastic, Solvent Based, Outdoor Use: Suitable for outdoor use on below-ambient services.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Childers Brand; H. B. Fuller Construction Products.
 - b. Foster Brand; H. B. Fuller Construction Products.
 - 2. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
 - 3. Service Temperature Range: Minus 50 to plus 220 deg F.
 - 4. Color: White Insert color.
- E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Foster Brand; H. B. Fuller Construction Products.
 - c. Knauf Insulation.
 - d. Vimasco Corporation.
 - 2. Water-Vapor Permeance: ASTM E96/E96M, greater than 1.0 perm at manufacturer's recommended dry film thickness.
 - 3. Service Temperature Range: 0 to plus 180 deg F Minus 20 to plus 180 deg F.
 - 4. Color: White Insert color.

2.5 LAGGING ADHESIVES

- A. Adhesives shall comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Foster Brand; H. B. Fuller Construction Products.
 - c. Vimasco Corporation.
 - 2. Adhesive shall be as recommended by insulation manufacturer and shall have a VOC content of 50 g/L or less.
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 4. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 - 5. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

6. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.
7. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
8. Service Temperature Range: 20 to plus 180 deg F 0 to plus 180 deg F.
9. Color: White.

2.6 SEALANTS

- A. Materials shall be as recommended by the insulation manufacturer and shall be compatible with insulation materials, jackets, and substrates.
- B. Joint Sealants:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Foster Brand; H. B. Fuller Construction Products.
 - c. Pittsburgh Corning Corporation.
 2. Permanently flexible, elastomeric sealant.
 3. Service Temperature Range: Minus 58 to plus 176 deg F Minus 100 to plus 300 deg F.
 4. Color: White or gray.
 5. Sealant shall have a VOC content of 420 g/L or less.
 6. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 7. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 8. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 9. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.

C. FSK and Metal Jacket Flashing Sealants:

1. Sealant shall have a VOC content of [420] <Insert value> g/L or less.
2. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
3. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
4. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
5. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.

D. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Or Equal.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.
5. Sealant shall have a VOC content of 420 g/L or less.
6. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
7. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
8. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

9. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.

2.7 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.
 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.

2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C1136, Type I, unless otherwise indicated.
- B. Underground Direct-Buried Jacket: 125-mil- thick vapor barrier and waterproofing membrane, consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Pittsburgh Corning Corporation.
 - b. Polyguard Products, Inc.

2.9 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. 3M Industrial Adhesives and Tapes Division.
 - b. Avery Dennison Corporation, Specialty Tapes Division.
 - c. Ideal Tape Co., Inc., an American Biltrite Company.
 - d. Knauf Insulation.
 2. Width: 3 inches .

3. Thickness: 11.5 mils .
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.10 SECUREMENTS

A. Bands:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ITW Insulation Systems; Illinois Tool Works, Inc.
 - b. RPR Products, Inc.
2. Stainless Steel: ASTM A240/A240M, Type 304 Type 316; 0.015 inch thick, 1/2 inch 3/4 inch wide with wing seal or closed seal.
3. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch 3/4 inchwide with wing seal or closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

C. Wire: 0.080-inch nickel-copper alloy 0.062-inch soft-annealed, stainless steel 0.062-inch soft-annealed, galvanized steel.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. C & F Wire.
 - b. Insert manufacturer's nameOr Equal.

2.11 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Just Manufacturing.
 - b. McGuire Manufacturing.
 - c. MVG Molded Products.
 - d. Truebro.
 - e. Zurn Industries, LLC.
2. Description: Manufactured plastic wraps for covering plumbing fixture hot-water supply hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

- B. Protective Shielding Piping Enclosures:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Truebro.
 - b. Zurn Industries, LLC.
 - 2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.

- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
 - 3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 4 inches o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.

5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 25 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.
- P. For above-ambient services, do not install insulation to the following:
 1. Vibration-control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.
 4. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.

- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
 - 1. Pipe: Install insulation continuously through floor penetrations.
 - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:
 - 1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as that of adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 - 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers, so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges, mechanical couplings, and unions, using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.6 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as that of straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

C. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as that of straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.7 FIELD-APPLIED JACKET INSTALLATION

- A. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches o.c. and at end joints.

3.8 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- C. Do not field paint aluminum or stainless steel jackets.

3.9 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections: Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective if they do not pass tests and inspections.

- D. Prepare test and inspection reports.

3.10 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Drainage piping located in crawl spaces.
 - 2. Underground piping.
 - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
 - 1. NPS 1 and Smaller: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
 - 2. NPS 1-1/4 and Larger: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- B. Domestic Hot:
 - 1. NPS 1-1/4 and Smaller: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
 - 2. NPS 1-1/2 and Larger: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- C. Stormwater and Overflow:
 - 1. All Pipe Sizes: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- D. Roof Drain and Overflow Drain Bodies:
 - 1. All Pipe Sizes: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

E. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

3.12 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Domestic Water Piping:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

B. Domestic Hot Water:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

3.13 UNDERGROUND, FIELD-APPLIED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 220719

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Copper tube and fittings.
 - 2. Dielectric fittings.

1.3 ACTION SUBMITTALS

- A. Product Data: For transition fittings and dielectric fittings.

1.4 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L and ASTM B 88, Type M water tube, drawn temper.

- B. Soft Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L water tube, annealed temper.
- C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- F. Copper Unions:
 - 1. MSS SP-123.
 - 2. Cast-copper-alloy, hexagonal-stock body.
 - 3. Ball-and-socket, metal-to-metal seating surfaces.
 - 4. Solder-joint or threaded ends.
- G. Copper, Brass, or Bronze Pressure-Seal-Joint Fittings:
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. Elkhart Products Corporation.
 - b. Mueller Industries, Inc.
 - c. Viega LLC.
 - 2. Minimum 200-psig working-pressure rating at 250 deg F.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105/A21.5.

- E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."
- F. Install shutoff valve immediately upstream of each dielectric fitting.
- G. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."
- H. Install domestic water piping with 0.25 percent slope downward toward drain and plumb.
- I. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- K. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- L. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- M. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- N. Install piping to permit valve servicing.
- O. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- P. Install piping free of sags and bends.
- Q. Install fittings for changes in direction and branch connections.
- R. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

- T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.2 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Braze Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.3 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric .
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric .
- D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.4 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for hangers, supports, and anchor devices in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Install hangers for copper, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- D. Install vinyl-coated hangers for piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- E. Support horizontal piping within 12 inches of each fitting.
- F. Support vertical runs of copper to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- G. Support vertical runs of piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.5 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.6 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

3.7 ADJUSTING

- A. Perform the following adjustments before operation:
 1. Close drain valves, hydrants, and hose bibbs.
 2. Open shutoff valves to fully open position.
 3. Open throttling valves to proper setting.
 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.8 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

- a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Repeat procedures if biological examination shows contamination.
 - e. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Clean non-potable domestic water piping as follows:
- 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.9 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Under-building-slab, domestic water, building-service piping, NPS 3 and smaller, shall be the following:
 - 1. Soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.

- E. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 8 and larger, shall be the following:
 - 1. Soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
- F. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:
 - 1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and brazed or soldered joints.
 - 2. Hard copper tube, ASTM B 88, Type L or; copper pressure-seal-joint fittings; and pressure-sealed joints.
- G. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and soldered joints.

3.10 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller.
 - 2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller.
 - 3. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 221116

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Vacuum breakers.
2. Water pressure-reducing valves.
3. Strainers.
4. Wall hydrants.
5. Post hydrants.
6. Drain valves.
7. Water-hammer arresters.
8. Trap-seal primer valves.
9. Water meters.

- B. Related Requirements:

1. Section 221116 "Domestic Water Piping" for water meters.
2. Section 224700 "Drinking Fountains" for water filters for water coolers.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

- A. Potable-water piping and components shall comply with NSF 61.
- B. Comply with NSF 372 for low lead.

2.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ames Fire & Waterworks; A WATTS Brand.
 - b. Apollo Valves; Conbraco Industries, Inc.
 - c. Cash Acme.
 - d. FEBCO; A WATTS Brand.
 - e. Rain Bird Corporation.
 - f. Toro Company (The).
 - g. WATTS.
 - h. Zurn Industries, LLC.
 - 2. Standard: ASSE 1001.
 - 3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
 - 4. Body: Bronze.
 - 5. Inlet and Outlet Connections: Threaded.
 - 6. Finish: Rough bronze Chrome plated.
- B. Hose-Connection Vacuum Breakers :
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo Valves; Conbraco Industries, Inc.
 - b. Prier Products, Inc.
 - 2. Standard: ASSE 1011.
 - 3. Body: Bronze, nonremovable, with manual drain.
 - 4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.

2.4 WATER PRESSURE-REDUCING VALVES

A. Water Regulators :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo Valves; Conbraco Industries, Inc.
 - b. Cash Acme.
 - c. Honeywell Water Controls.
 - d. WATTS.
 - e. Zurn Industries, LLC.
2. Standard: ASSE 1003.
3. Pressure Rating: Initial working pressure of 150 psig.
4. Body: Bronze with chrome-plated finish for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
5. Valves for Booster Heater Water Supply: Include integral bypass.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

2.5 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers :

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron.
3. End Connections: Threaded for NPS 2 and smaller.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:
 - a. Strainers NPS 2 and Smaller: 0.020 0.033 0.062 Insert dimension inch.
 - b. Strainers NPS 2-1/2 to NPS 4: 0.045 0.062 0.125 Insert dimension inch.
 - c. Strainers NPS 5 and Larger: 0.10 0.125 0.25 Insert dimension inch.
6. Drain: Pipe plug.

2.6 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg. Co.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. WATTS.

- e. Woodford Manufacturing Company.
 - f. Zurn Industries, LLC.
2. Standard: ASME A112.21.3M for concealed or exposed-outlet, self-draining wall hydrants.
 3. Pressure Rating: 125 psig.
 4. Operation: Loose key.
 5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
 6. Inlet: NPS 3/4 or NPS 1.
 7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
 8. Box: Deep, flush mounted with cover.
 9. Box and Cover Finish: Polished nickel bronze Chrome plated Insert finishStainless Steel.
 10. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
 11. Nozzle and Wall-Plate Finish: Polished nickel bronze.
 12. Operating Keys(s): Two with each wall hydrant.

B. Vacuum Breaker Wall Hydrants :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A.Y. McDonald Mfg. Co.
 - b. Prier Products, Inc.
2. Standard: ASSE 1019, Type A or Type B.
3. Type: Freeze-resistant, automatic draining with integral air-inlet valve.
4. Classification: Type A, for automatic draining with hose removed or Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
5. Pressure Rating: 125 psig.
6. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
7. Inlet: NPS 1/2 or NPS 3/4.
8. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

2.7 POST HYDRANTS

A. Nonfreeze, Nondraining-Type Post Hydrants <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Murdock-Super Secur; a member of Morris Group International.
2. Operation: Lever-piston operating mechanism and nondraining water-storage reservoir, designed without drain.
3. Length: As required for burial of valve below frost line.

4. Inlet: NPS 1 threaded.
5. Outlet:
 - a. NPS 1 outlet and coupling plug for 1-inch hose.
 - b. NPS 1 by NPS 3/4 adapter with nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
 - c. Garden-hose thread complying with ASME B1.20.7 on outlet.
 - d. NPS 1 by NPS 3/4 adapter with nonremovable, drainable, hose-connection backflow preventer complying with ASSE 1052.
 - e. Garden-hose thread complying with ASME B1.20.7 on outlet.

2.8 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves <Insert drawing designation if any>:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.9 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL, Inc.
 - b. Jay R. Smith Mfg. Co.
 - c. Josam Company.
 - d. MIFAB, Inc.
 - e. Precision Plumbing Products.
 - f. Sioux Chief Manufacturing Company, Inc.
 - g. Tyler Pipe; a subsidiary of McWane Inc.
 - h. WATTS.
 - i. Zurn Industries, LLC.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Metal bellows Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.10 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg. Co.
 - b. MIFAB, Inc.
 - c. Precision Plumbing Products.
 - d. Sioux Chief Manufacturing Company, Inc.
 - e. WATTS.
2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

B. Drainage-Type, Trap-Seal Primer Device :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg. Co.
2. Standard: ASSE 1044, lavatory P-trap with NPS 3/8 minimum, trap makeup connection.
3. Size: NPS 1-1/4 minimum.
4. Material: Chrome-plated, cast brass.

2.11 WATER METERS

A. Displacement-Type Water Meters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AALIANT.
 - b. ABB.
 - c. Carlon Meter.
 - d. Mueller Co.
 - e. Schlumberger Limited.
 - f. Sensus.
2. Standard: AWWA C700.
3. Pressure Rating: 150-psig working pressure.
4. Body Design: Nutating disc; totalization meter.

5. Registration: In gallons or cubic feet as required by utility company.
 6. Case: Bronze.
 7. End Connections: Threaded.
- B. Remote Registration System: Encoder type complying with AWWA C707; modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly as required by utility company.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Water Regulators: Install with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.
- B. Y-Pattern Strainers: For water, install on supply side of each water pressure-reducing valve.
- C. Nonfreeze, Nondraining-Type Post Hydrants: Set in concrete or pavement.
- D. Water-Hammer Arresters: Install in water piping according to PDI-WH 201.
- E. Supply-Type, Trap-Seal Primer Device: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- F. Drainage-Type, Trap-Seal Primer Device: Install as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

3.2 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.
- C. Comply with requirements for grounding equipment in Section 260526 "Grounding and Bonding for Electrical Systems."

3.3 IDENTIFICATION

- A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

END OF SECTION 221119

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Hub-and-spigot, cast-iron soil pipe and fittings.
 - 2. Hubless, cast-iron soil pipe and fittings.
 - 3. Specialty pipe fittings.
 - 4. Encasement for underground metal piping.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.

2.2 PIPING MATERIALS

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AB & I Foundry; a part of the McWane family of companies.
 - 2. Charlotte Pipe and Foundry Company.
 - 3. NewAge Casting.

4. Tyler Pipe; a part of McWane family of companies.
- B. Pipe and Fittings: ASTM A 74, Service class(es).
- C. Gaskets: ASTM C 564, rubber.
- D. Caulking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.4 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. AB & I Foundry; a part of the McWane family of companies.
 2. Charlotte Pipe and Foundry Company.
 3. NewAge Casting.
 4. Tyler Pipe; a part of McWane family of companies.
- B. Pipe and Fittings: ASTM A 888 or CISPI 301.

2.5 SPECIALTY PIPE FITTINGS

- A. Transition Couplings:
 1. Shielded, Nonpressure Transition Couplings:
 - a. Standard: ASTM C 1460.
 - b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - c. End Connections: Same size as and compatible with pipes to be joined.
- B. Dielectric Fittings:
 1. Dielectric Unions:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) A.Y. McDonald Mfg. Co.

2.6 ENCASUREMENT FOR UNDERGROUND METAL PIPING

- A. Standard: ASTM A 674 or AWWA C105/A 21.5.
- B. Material: high-density, cross-laminated polyethylene film of 0.004-inch minimum thickness.

- C. Form: Sheet or tube.
- D. Color: Black or natural.

PART 3 - EXECUTION

3.1 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
 - 1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
 - 2. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.
 - 1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
 - 2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.

- a. Straight tees, elbows, and crosses may be used on vent lines.
- 3. Do not change direction of flow more than 90 degrees.
- 4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
 - a. Reducing size of waste piping in direction of flow is prohibited.
- K. Lay buried building waste piping beginning at low point of each system.
 - 1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
 - 2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
 - 3. Maintain swab in piping and pull past each joint as completed.
- L. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 and smaller; 2 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.
- N. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
- O. Plumbing Specialties:
 - 1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.
 - a. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
 - b. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
 - 2. Install drains in sanitary waste gravity-flow piping.
 - a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."
- P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

- Q. Install sleeves for piping penetrations of walls, ceilings, and floors.
 - 1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- R. Install sleeve seals for piping penetrations of concrete walls and slabs.
 - 1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

3.3 JOINT CONSTRUCTION

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.
- C. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1.
 - 1. Cut threads full and clean using sharp dies.
 - 2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
 - c. Do not use pipe sections that have cracked or open welds.

3.4 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
 - 1. Install transition couplings at joints of piping with small differences in ODs.
 - 2. In Waste Drainage Piping: Shielded, nonpressure transition couplings.
- B. Dielectric Fittings:
 - 1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
 - 2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
 - 3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.
 - 4. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.5 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
 - 2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
 - 3. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 4. Install individual, straight, horizontal piping runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 - 5. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 6. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install hangers for soil piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- C. Support horizontal piping and tubing within 12 inches of each fitting and coupling.
- D. Support vertical runs of soil piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect waste and vent piping to the following:
 - 1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
 - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - 3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
 - 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
 - 5. Equipment: Connect waste piping as indicated.
 - a. Provide shutoff valve if indicated and union for each connection.

- b. Use flanges instead of unions for connections NPS 2-1/2 and larger.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- E. Make connections according to the following unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.7 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping.
- B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.
 - a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.
 - a. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.
 - a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
 - b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
 - c. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.
 - a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.
 - b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
 - c. Air pressure must remain constant without introducing additional air throughout period of inspection.
 - d. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.9 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Repair damage to adjacent materials caused by waste and vent piping installation.

3.10 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 4 and smaller shall be the following:
 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
 3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

- C. Aboveground, soil and waste piping NPS 5 and larger shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
 - 3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- D. Aboveground, vent piping NPS 4 and smaller shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
 - 3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- E. Aboveground, vent piping NPS 5 and larger shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
 - 3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- F. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
 - 1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
 - 2. Hubless, cast-iron soil pipe and fittings; heavy-duty cast-iron hubless-piping couplings; and coupled joints.
 - 3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- G. Underground, soil and waste piping NPS 5 and larger shall be any of the following:
 - 1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
 - 2. Hubless, cast-iron soil pipe and fittings; cast-iron hubless-piping couplings; coupled joints.
 - 3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Cleanouts.
- 2. Roof flashing assemblies.
- 3. Miscellaneous sanitary drainage piping specialties.

- B. Related Requirements:

- 1. Section 221423 "Storm Drainage Piping Specialties" for trench drains for storm water, channel drainage systems for storm water, roof drains, and catch basins.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene.
- B. FOG: Fats, oils, and greases.
- C. PVC: Polyvinyl chloride.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rated capacities, operating characteristics, and accessories for the following:

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTIONS

- A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing, and marked for intended location and application.

2.2 CLEANOUTS

A. Cast-Iron Exposed Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Jay R. Smith Mfg. Co.
 - b. Josam Company.
 - c. Oatey.
 - d. Sioux Chief Manufacturing Company, Inc.
 - e. Tyler Pipe; a subsidiary of McWane Inc.
 - f. WATTS.
 - g. Zurn Industries, LLC.
2. Standard: ASME A112.36.2M for adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Adjustable housing.
5. Body or Ferrule: Cast iron.
6. Outlet Connection: Spigot.
7. Adjustable Housing Material: Cast iron with threads.
8. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
9. Frame and Cover Shape: Round.

B. Cast-Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Jay R. Smith Mfg. Co.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. Tyler Pipe; a subsidiary of McWane Inc.
 - e. WATTS.
 - f. Zurn Industries, LLC.
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
5. Closure Plug:
 - a. Cast iron.
 - b. Countersunk head.
 - c. Drilled and threaded for cover attachment screw.

- d. Size: Same as or not more than one size smaller than cleanout size.
- 6. Wall Access: Round, deep, chrome-plated bronze cover plate with screw.
- 7. Wall Access: Round, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

2.3 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Acorn Engineering Company.
 - b. Thaler Metal Industries Ltd.
 - c. Zurn Industries, LLC.
- 2. Description: Manufactured assembly made of 4.0-lb/sq. ft., 0.0625-inch- thick, lead flashing collar and skirt extending at least 6 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.
 - a. Open-Top Vent Cap: Without cap.
 - b. Low-Silhouette Vent Cap: With vandal-proof vent cap.
 - c. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Floor-Drain, Trap-Seal Primer Fittings:

- 1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
- 2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

B. Air-Gap Fittings:

- 1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
- 2. Body: Bronze or cast iron.
- 3. Inlet: Opening in top of body.
- 4. Outlet: Larger than inlet.
- 5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

C. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

D. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 2. Locate at each change in direction of piping greater than 45 degrees.
 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 4. Locate at base of each vertical soil and waste stack.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof. Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."
- E. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof. Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."
- F. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
 2. Size: Same as floor drain inlet.
- G. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.

- H. Install wood-blocking reinforcement for wall-mounting-type specialties.
- I. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

- A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

3.3 FLASHING INSTALLATION

- A. Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."
- B. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required.
- C. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
 - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- D. Set flashing on floors and roofs in solid coating of bituminous cement.
- E. Secure flashing into sleeve and specialty clamping ring or device.
- F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.4 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

3.5 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

SECTION 221319.13 - SANITARY DRAINS

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. Floor drains.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene styrene.
- B. FRP: Fiberglass-reinforced plastic.
- C. HDPE: High-density polyethylene.
- D. PE: Polyethylene.
- E. PP: Polypropylene.
- F. PVC: Polyvinyl chloride.

1.4 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 DRAIN ASSEMBLIES

- A. Sanitary drains shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic sanitary piping specialty components.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Commercial Enameling Company.
 - b. Jay R. Smith Mfg. Co.
 - c. Josam Company.
 - d. MIFAB, Inc.
 - e. Prier Products, Inc.
 - f. Sioux Chief Manufacturing Company, Inc.
 - g. Wade; a subsidiary of McWane Inc.
 - h. WATTS.
 - i. Zurn Industries, LLC.
2. Standard: ASME A112.6.3.
3. Pattern: Area Floor Funnel floor Sanitary Insert pattern drain.
4. Body Material: Gray iron.
5. Seepage Flange: Not required Required.
6. Anchor Flange: Not required Required.
7. Clamping Device: Not required Required.
8. Outlet: Bottom Side Insert type.
9. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel Not required Insert material.
10. Top or Strainer Material: Nickel bronze .
11. Top of Body and Strainer Finish: Nickel bronze.
12. Top Shape: Round Square Insert shape.
13. Inlet Fitting: Not required Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
14. Trap Pattern: Deep-seal P-trap Standard P-trap Not required Insert pattern.
15. Trap Features: Cleanout Trap-seal primer valve drain connection Cleanout and trap-seal primer valve drain connection Not required Insert type.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 1. Position floor drains for easy access and maintenance.
 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
 3. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.

- b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
 - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
- 4. Install floor-drain flashing collar or flange, so no leakage occurs between drain and adjoining flooring.
 - a. Maintain integrity of waterproof membranes where penetrated.
- 5. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

3.2 CONNECTIONS

- A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

3.3 LABELING AND IDENTIFYING

- A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319.13

SECTION 221413 - FACILITY STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Hub-and-spigot, cast-iron soil pipe and fittings.
2. Hubless, cast-iron soil pipe and fittings.
3. PVC pipe and fittings.
4. Specialty pipe and fittings.
5. Encasement for underground metal piping.

1.3 ACTION SUBMITTALS

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

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
 1. Storm Drainage Piping: 10-foot head of water.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. AB & I Foundry; a part of the McWane family of companies.

2. Charlotte Pipe and Foundry Company.
 3. NewAge Casting.
 4. Tyler Pipe; a part of McWane family of companies.
- B. Pipe and Fittings:
1. Marked with CISPI collective trademark and NSF certification mark.
 2. Class: ASTM A 74, Service Extra Heavy class(es).
- C. Gaskets: ASTM C 564, rubber.
- D. Caulking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AB & I Foundry; a part of the McWane family of companies.
 2. Charlotte Pipe and Foundry Company.
 3. NewAge Casting.
 4. Tyler Pipe; a part of McWane family of companies.
- B. Pipe and Fittings:
1. Marked with CISPI collective trademark and NSF certification mark.
 2. Standard: ASTM A 888 or CISPI 301.
- C. CISPI, Hubless-Piping Couplings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ANACO-Husky.
 - b. Charlotte Pipe and Foundry Company.
 - c. Dallas Specialty & Mfg. Co.
 - d. Fernco Inc.
 - e. Matco-Norca.
 - f. MIFAB, Inc.
 - g. Mission Rubber Company, LLC; a division of MCP Industries.
 - h. NewAge Casting.
 - i. Insert manufacturer's name.
 2. Couplings shall bear CISPI collective trademark and NSF certification mark.
 3. Standards: ASTM C 1277 and CISPI 310. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- D. Heavy-Duty, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ideal Clamp Products, Inc.
 - b. Tyler Pipe; a subsidiary of McWane Inc.
2. Standard: ASTM C 1540. <Insert standard>.
3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 PVC PIPE AND FITTINGS - EXTERIOR BELOW GRADE

1. Mueller Industries, Inc.
 2. National Pipe and Plastic, Inc.
- B. Solid-Wall PVC Pipe: ASTM D 2665; drain, waste, and vent.
- C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- D. Solvent Cement: ASTM D 2564.

2.6 SPECIALTY PIPE FITTINGS

- A. Dielectric Fittings:
1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
 2. Dielectric Unions:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) A.Y. McDonald Mfg. Co.

2.7 ENCASEMENT FOR UNDERGROUND METAL PIPING

- A. Standard: ASTM A 674 or AWWA C105/A 21.5.
- B. Material: High-density, crosslaminated polyethylene film of 0.004-inch minimum thickness.

PART 3 - EXECUTION

3.1 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
 - 1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
 - 2. Install piping as indicated unless deviations from layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Make changes in direction for piping using appropriate branches, bends, and long-sweep bends.
 - 1. Do not change direction of flow more than 90 degrees.
 - 2. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
 - a. Reducing size of drainage piping in direction of flow is prohibited.
- K. Lay buried building piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
 2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
 3. Maintain swab in piping and pull past each joint as completed.
- L. Install piping at the following minimum slopes unless otherwise indicated:
1. Building Storm Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 2 percent downward in direction of flow for piping NPS 4 and larger.
 2. Horizontal Storm Drainage Piping: 2 percent downward in direction of flow.
- M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.
- N. Install steel piping according to applicable plumbing code.
- O. Install aboveground PVC piping according to ASTM D 2665.
- P. Install underground PVC piping according to ASTM D 2321.
- Q. Install engineered siphonic drain specialties and storm drainage piping in locations indicated.
- R. Install underground, ductile-iron, force-main piping according to AWWA C600.
1. Install buried piping inside building between wall and floor penetrations and connection to storm sewer piping outside building with restrained joints.
 2. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
 3. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.
- S. Plumbing Specialties:
1. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping.
 - a. Comply with requirements for cleanouts specified in Section 221423 "Storm Drainage Piping Specialties."
 2. Install drains in storm drainage gravity-flow piping.
 - a. Comply with requirements for drains specified in Section 221423 "Storm Drainage Piping Specialties."

- T. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- U. Install sleeves for piping penetrations of walls, ceilings, and floors.
 - 1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- V. Install sleeve seals for piping penetrations of concrete walls and slabs.
 - 1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

3.3 JOINT CONSTRUCTION

- A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Hub-and-Spigot, Cast-Iron Soil Piping Caulked Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum caulked joints.
- C. Hubless, Cast-Iron Soil Piping Coupled Joints:
 - 1. Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1.
 - 1. Cut threads full and clean using sharp dies.
 - 2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
 - c. Do not use pipe sections that have cracked or open welds.

3.4 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
 - 1. Install transition couplings at joints of piping with small differences in ODs.
 - 2. In Drainage Piping: Unshielded , nonpressure transition couplings.
- B. Dielectric Fittings:
 - 1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.
4. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.5 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements for hangers, supports, and anchor devices specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
 2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
 3. Vertical Piping: MSS Type 8 or Type 42, clamps.
 4. Install individual, straight, horizontal piping runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 5. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 6. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install hangers for cast-iron piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- C. Support horizontal piping and tubing within 12 inches of each fitting and coupling.
- D. Support vertical cast-iron to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent, but as a minimum at base and at each floor.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect storm drainage piping to roof drains and storm drainage specialties.
 1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance.

- E. Make connections according to the following unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.7 IDENTIFICATION

- A. Identify exposed storm drainage piping.
- B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.
 - a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved.
 - a. Expose work that was covered or concealed before it was tested.
 - 3. Test Procedure:
 - a. Test storm drainage piping on completion of roughing-in.
 - b. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.
 - 4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

5. Prepare reports for tests and required corrective action.
- C. Piping will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.9 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.10 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground storm drainage piping NPS 6 and smaller shall be any of the following:
 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 2. Hubless, cast-iron soil pipe and fittings; heavy-duty, hubless-piping couplings; and coupled joints.
- C. Aboveground, storm drainage piping NPS 8 and larger shall be any of the following:
 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 2. Hubless, cast-iron soil pipe and fittings; heavy-duty, hubless-piping couplings; and coupled joints.
 3. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- D. Underground storm drainage piping NPS 6 and smaller shall be any of the following:
 1. Extra Heavy class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 2. Hubless, cast-iron soil pipe and fittings; heavy-duty, cast-iron, hubless-piping couplings; and coupled joints.
 3. Exterior: Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 4. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- E. Underground, storm drainage piping NPS 8 and larger shall be any of the following:
 1. Extra Heavy class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 2. Hubless, cast-iron soil pipe and fittings; heavy-duty, cast-iron, hubless-piping couplings; and coupled joints.
 3. Exterior: Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

4. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

END OF SECTION 221413

SECTION 221423 - STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Metal roof drains.
- 2. Miscellaneous storm drainage piping specialties.
- 3. Cleanouts.

- B. Related Requirements:

- 1. Section 076200 "Sheet Metal Flashing and Trim" for penetrations of roofs.

1.3 ACTION SUBMITTALS

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

1.4 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 METAL ROOF DRAINS

- A. Cast-Iron, Medium-Sump, General-Purpose Roof Drains:

- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Jay R. Smith Mfg. Co.
 - b. Josam Company.
 - c. Marathon Roofing Products.

- d. MIFAB, Inc.
 - e. Portals Plus; a Hart & Cooley, Inc. company.
 - f. Wade; a subsidiary of McWane Inc.
 - g. Watts; a Watts Water Technologies company.
 - h. Zurn Industries, LLC.
- 2. Standard: ASME A112.6.4.
 - 3. Body Material: Cast iron.
 - 4. Dimension of Body: 8- to 12-inch diameter.
 - 5. Combination Flashing Ring and Gravel Stop: Required.
 - 6. Flow-Control Weirs: Not required.
 - 7. Outlet: Bottom.
 - 8. Dome Material: Cast iron.

2.2 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

A. Downspout Adaptors:

- 1. Description: Manufactured, gray-iron casting, for attaching to horizontal-outlet, parapet roof drain and to exterior, sheet metal downspout.
- 2. Size: Inlet size to match parapet drain outlet.

2.3 CLEANOUTS

A. Cast-Iron Exposed Cleanouts:

- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Jay R. Smith Mfg. Co.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. Tyler Pipe; a subsidiary of McWane Inc.
 - e. Wade; a subsidiary of McWane Inc.
 - f. Watts; a Watts Water Technologies company.
 - g. Zurn Industries, LLC.
- 2. Standard: ASME A112.36.2M.
- 3. Size: Same as connected branch.
- 4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
- 5. Closure: Countersunk or raised-head, cast-iron plug.
- 6. Closure Plug Size: Same as, or not more than, one size smaller than cleanout size.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.
 - 1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
 - 2. Install expansion joints, if indicated, in roof drain outlets.
 - 3. Position roof drains for easy access and maintenance.
- B. Install downspout adapters on outlet of back-outlet parapet roof drains and connect to sheet metal downspouts.
- C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Section 221413 "Facility Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.

3.4 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221423

SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Commercial, electric, storage, domestic-water heaters.
 - 2. Flow-control, electric, tankless, domestic-water heaters.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings:
 - 1. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of commercial and tankless, electric, domestic-water heater.
- B. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
- C. Source quality-control reports.
- D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For electric, domestic-water heaters to include emergency, operation, and maintenance manuals.

1.6 WARRANTY

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.
- B. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.

2.2 COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS

- A. Commercial, Electric, Storage, Domestic-Water Heaters:
 - 1. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
 - 2. Standard: UL 1453.
 - 3. Storage-Tank Construction: ASME-code, steel arrangement.
 - a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.
 - 1) NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.
 - b. Pressure Rating: 150 psig.
 - c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.
 - 4. Factory-Installed, Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Drain Valve: Corrosion-resistant metal with hose-end connection.
 - c. Insulation: Comply with ASHRAE/IES 90.1.
 - d. Jacket: Steel with enameled finish or high-impact composite material.
 - e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
 - f. Temperature Control: Adjustable thermostat.
 - g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
 - h. Relief Valves: ASME rated and stamped for combination temperature-and-pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.

2.3 ELECTRIC, TANKLESS, DOMESTIC-WATER HEATERS

A. Flow-Control, Electric, Tankless, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bosch Thermotechnology Corp.
 - b. Bradley Corporation.
 - c. Chronomite Laboratories, Inc.
 - d. Eemax, Inc.
 - e. Stiebel Eltron, Inc.
2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
3. Standard: UL 499 for electric, tankless, (domestic-water-heater) heating appliance.
4. Construction: Copper piping or tubing complying with NSF 61 and NSF 372 barrier materials for potable water, without storage capacity.
 - a. Connections: ASME B1.20.1 pipe thread.
 - b. Pressure Rating: 150 psig.
 - c. Heating Element: Resistance heating system.
 - d. Temperature Control: Flow-control fitting.
 - e. Safety Control: High-temperature-limit cutoff device or system.
 - f. Jacket: Aluminum or steel with enameled finish or plastic.
5. Support: Bracket for wall mounting.

2.4 SOURCE QUALITY CONTROL

- A. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections.
- B. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

- A. Electric, Tankless, Domestic-Water Heater Mounting: Install electric, tankless, domestic-water heaters at least 18 inches above floor on wall bracket.
 1. Maintain manufacturer's recommended clearances.
 2. Arrange units so controls and devices that require servicing are accessible.
 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

4. Install anchor bolts to elevations required for proper attachment to supported equipment.
 5. Anchor domestic-water heaters to substrate.
- B. Install electric, domestic-water heaters level and plumb, in accordance with layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping,"
- C. Install pressure relief valves in water piping for electric, domestic-water heaters without storage. Extend domestic-water heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- D. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."
- E. Install dielectric fittings in all locations where piping of dissimilar metals is to be joined. The wetted surface of the dielectric fitting contacted by potable water shall contain less than 0.25 percent of lead by weight.

3.2 PIPING CONNECTIONS

- A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

2. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 223300

SECTION 224213.13 - COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Water closets.
 - 2. Flushometer valves and tanks.
 - 3. Toilet seats.
 - 4. Supports.

1.3 DEFINITIONS

- A. Effective Flush Volume: Average of two reduced flushes and one full flush per fixture.
- B. Remote Water Closet: Located more than 30 feet from other drain line connections or fixture and where less than 1.5 drainage fixture units are upstream of the drain line connection.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flushometer valves to include in operation and maintenance manuals.

1.6 CODE REFERENCES

- A. Plumbing fixtures and accessories provided in a toilet room or bathing room required to comply with CBC Section 11B-213.2 shall comply with CBC Section 11B-213.3.
- B. All single-user toilet facilities shall be identified as Gender Neutral facilities by a door symbol that complies with CBC Sections 11B-216.8 and 11B-703.7.2.6.3 No pictogram, text or braille is required on the symbol. If tactile jamb signage is provided, the signage shall comply with the appropriate technical requirements of CBC Section 11B-703. Examples of appropriate designations are “ALL-GENDER RESTROOM”, “RESTROOM” OR “UNISEX RESTROOM”. DSA BU 17-01.
- C. Accessible plumbing fixtures shall comply with all the requirements in CBC Division 6.
- D. Clearance around accessible water closets and in toilet compartments shall be 60 inches minimum measured perpendicular from the side wall and 56 inches minimum measured perpendicular from the side wall and 56 inches minimum measured perpendicular from the rear wall per CBC Section 11B-604.3.1.
- E. Heights and location of all accessible fixtures shall be mounted according to CBC Sections 11B-602 through 11B-612.
- F. Accessible fixture controls shall comply with CBC Sections 11B-602.3 for drinking fountains, 11B-604.6 for water closets, 11B-604.9.5 for 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.
- G. 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 11B606.3 and 11B-606.7
- H. Water supply and drain pipes under accessible lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under accessible lavatories and sinks. CBC Section 11B-606.5

PART 2 - PRODUCTS

2.1 WALL-MOUNTED WATER CLOSETS

- A. Water Closets: Wall mounted, top spud, accessible.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard America.
 - b. Briggs Company (The).

- c. Capizzi.
 - d. Crane Plumbing, L.L.C.
 - e. FNW; Ferguson Enterprises, Inc.
 - f. Gerber Plumbing Fixtures LLC.
 - g. Kohler Co.
 - h. Mansfield Plumbing Products LLC.
 - i. Peerless Pottery Sales, Inc.
 - j. Sloan Valve Company.
 - k. TOTO USA, INC.
 - l. Zurn Industries, LLC.
2. Bowl:
- a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
 - b. Material: Vitreous china.
 - c. Type: Siphon jet.
 - d. Style: Flushometer valve.
 - e. Height: Standard.
 - f. Rim Contour: Elongated.
 - g. Water Consumption: 1.28 gal. per flush.
 - h. Spud Size and Location: NPS 1-1/2; top.
3. Support: Water closet carrier.
4. Water-Closet Mounting Height: Standard and Handicapped/elderly according to ICC/ANSI A117.1.

2.2 FLUSHOMETER VALVES

A. Lever-Handle, Diaphragm Flushometer Valves:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Delany Products.
 - b. Gerber Plumbing Fixtures LLC.
 - c. Sloan Valve Company.
 - d. Zurn Industries, LLC.
- 2. Standard: ASSE 1037.
- 3. Minimum Pressure Rating: 125 psig.
- 4. Features: Include integral check stop and backflow-prevention device.
- 5. Material: Brass body with corrosion-resistant components.
- 6. Exposed Flushometer-Valve Finish: Chrome plated.
- 7. Style: Exposed.
- 8. Consumption: 1.28 gal. per flush.

2.3 TOILET SEATS

A. Toilet Seats:

Murrieta Elementary School New CR Bldg.
 Murrieta Valley Unified School District
 BakerNowicki Design Studio #18009-00

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1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard America.
 - b. Bemis Manufacturing Company.
 - c. Centoco Manufacturing Corporation.
 - d. Church Seats; Bemis Manufacturing Company.
 - e. Jones Stephens Corp.
 - f. Kohler Co.
 - g. Olsonite Seat Co.
 - h. Sanderson Plumbing Products, Inc.
 - i. Sperzel of Lexington.
 - j. TOTO USA, INC.
 - k. Zurn Industries, LLC.
2. Standard: IAPMO/ANSI Z124.5.
3. Material: Plastic.
4. Type: Commercial (Heavy duty).
5. Shape: Elongated rim, open front.
6. Hinge: Check Self-sustaining Self-sustaining, check Self-raising.
7. Hinge Material: Noncorroding metal.
8. Seat Cover: Not required.
9. Color: White.

2.4 SUPPORTS

A. Water Closet Carrier:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Zurn Industries, LLC.
 - b. Insert manufacturer's nameAmerican Standard.
2. Standard: ASME A112.6.1M.
3. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.
- B. Examine walls and floors for suitable conditions where water closets will be installed.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Water-Closet Installation:

1. Install level and plumb according to roughing-in drawings.
2. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:

1. Use carrier supports with waste-fitting assembly and seal.
2. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

C. Flushometer-Valve Installation:

1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
4. Install actuators in locations that are easy for people with disabilities to reach.
5. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

D. Install toilet seats on water closets.

E. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.

F. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.

3.3 CONNECTIONS

- A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.

- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.4 ADJUSTING

- A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.

3.5 CLEANING AND PROTECTION

- A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed water closets and fittings.

END OF SECTION 224213.13

SECTION 224213.16 - COMMERCIAL URINALS

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. Urinals.
 - 2. Flushometer valves.
 - 3. Supports.

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 urinals.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flushometer valves to include in operation and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

1.6 CODE REFERENCES

- A. Plumbing fixtures and accessories provided in a toilet room or bathing room required to comply with CBC Section 11B-213.2 shall comply with CBC Section 11B-213.3.

- B. All single-user toilet facilities shall be identified as Gender Neutral facilities by a door symbol that complies with CBC Sections 11B-216.8 and 11B-703.7.2.6.3 No pictogram, text or braille is required on the symbol. If tactile jamb signage is provided, the signage shall comply with the appropriate technical requirements of CBC Section 11B-703. Examples of appropriate designations are “ALL-GENDER RESTROOM”, “RESTROOM” OR “UNISEX RESTROOM”. DSA BU 17-01.
- C. Accessible plumbing fixtures shall comply with all the requirements in CBC Division 6.
- D. Clearance around accessible water closets and in toilet compartments shall be 60 inches minimum measured perpendicular from the side wall and 56 inches minimum measured perpendicular from the side wall and 56 inches minimum measured perpendicular from the rear wall per CBC Section 11B-604.3.1.
- E. Heights and location of all accessible fixtures shall be mounted according to CBC Sections 11B-602 through 11B-612.
- F. Accessible fixture controls shall comply with CBC Sections 11B-602.3 for drinking fountains, 11B-604.6 for water closets, 11B-604.9.5 for 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.
- G. 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 11B606.3 and 11B-606.7
- H. Water supply and drain pipes under accessible lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under accessible lavatories and sinks. CBC Section 11B-606.5

PART 2 - PRODUCTS

2.1 WALL-HUNG URINALS

- A. Urinals : Wall hung, back outlet, washout, accessible.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard America.
 - b. Kohler Co.
 - c. Peerless Pottery Sales, Inc.
 - d. Zurn Industries, LLC.
 - 2. Fixture:

- a. Material: Vitreous china.
 - b. Type: Washout with extended shields.
 - c. Water Consumption: Low.
 - d. Spud Size and Location: NPS 3/4, top.
 - e. Outlet Size and Location: NPS 2 , back.
 - f. Color: White.
3. Waste Fitting:
- a. Standard: ASME A112.18.2/CSA B125.2 for coupling.
4. Urinal Mounting Height: Standard Handicapped/elderly according to ICC A117.1.

2.2 URINAL FLUSHOMETER VALVES

A. Lever-Handle, Diaphragm Flushometer Valves :

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Delany Products.
 - b. Gerber Plumbing Fixtures LLC.
 - c. Sloan Valve Company.
 - d. Zurn Industries, LLC.
- 3. Standard: ASSE 1037.
- 4. Minimum Pressure Rating: 125 psig .
- 5. Features: Include integral check stop and backflow-prevention device.
- 6. Material: Brass body with corrosion-resistant components.
- 7. Exposed Flushometer-Valve Finish: Chrome plated.
- 8. Panel Finish: Chrome plated or stainless steel.
- 9. Style: Exposed.
- 10. Consumption: per flush.
- 11. Minimum Inlet: NPS 3/4.

2.3 SUPPORTS

A. Type II Urinal Carrier:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.
 - d. Wade Drains.

- e. Watts; a Watts Water Technologies company.
- f. Zurn Industries, LLC.
- g. American Standard
- h. Insert manufacturer's name.

2. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before urinal installation.
- B. Examine walls and floors for suitable conditions where urinals will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Urinal Installation:

- 1. Install urinals level and plumb according to roughing-in drawings.
- 2. Install wall-hung, back-outlet urinals onto waste fitting seals and attached to supports.
- 3. Install accessible, wall-mounted urinals at mounting height for the handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:

- 1. Install supports, affixed to building substrate, for wall-hung urinals.
- 2. Use off-floor carriers with waste fitting and seal for back-outlet urinals.
- 3. Use carriers without waste fitting for urinals with tubular waste piping.
- 4. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.

C. Flushometer-Valve Installation:

- 1. Install flushometer-valve water-supply fitting on each supply to each urinal.
- 2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
- 3. Install lever-handle flushometer valves for accessible urinals with handle mounted on open side of compartment.

D. Wall Flange and Escutcheon Installation:

- 1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
- 2. Install deep-pattern escutcheons if required to conceal protruding fittings.

E. Joint Sealing:

1. Seal joints between urinals and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to urinal color.
3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

- A. Connect urinals with water supplies and soil, waste, and vent piping. Use size fittings required to match urinals.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to urinals, allow space for service and maintenance.

3.4 ADJUSTING

- A. Operate and adjust urinals and controls. Replace damaged and malfunctioning urinals, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.

3.5 CLEANING AND PROTECTION

- A. Clean urinals and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed urinals and fittings.

END OF SECTION 224213.16

SECTION 224216.13 - COMMERCIAL LAVATORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Lavatories.
2. Faucets.
3. Supply fittings.
4. Waste fittings.
5. Supports.

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 lavatories.
 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.
 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Servicing and adjustments of automatic faucets.

1.5 CODE REFERENCES

- A. Plumbing fixtures and accessories provided in a toilet room or bathing room required to comply with CBC Section 11B-213.2 shall comply with CBC Section 11B-213.3.

- B. All single-user toilet facilities shall be identified as Gender Neutral facilities by a door symbol that complies with CBC Sections 11B-216.8 and 11B-703.7.2.6.3 No pictogram, text or braille is required on the symbol. If tactile jamb signage is provided, the signage shall comply with the appropriate technical requirements of CBC Section 11B-703. Examples of appropriate designations are “ALL-GENDER RESTROOM”, “RESTROOM” OR “UNISEX RESTROOM”. DSA BU 17-01.
- C. Accessible plumbing fixtures shall comply with all the requirements in CBC Division 6.
- D. Clearance around accessible water closets and in toilet compartments shall be 60 inches minimum measured perpendicular from the side wall and 56 inches minimum measured perpendicular from the side wall and 56 inches minimum measured perpendicular from the rear wall per CBC Section 11B-604.3.1.
- E. Heights and location of all accessible fixtures shall be mounted according to CBC Sections 11B-602 through 11B-612.
- F. Accessible fixture controls shall comply with CBC Sections 11B-602.3 for drinking fountains, 11B-604.6 for water closets, 11B-604.9.5 for 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.
- G. 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 11B606.3 and 11B-606.7
- H. Water supply and drain pipes under accessible lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under accessible lavatories and sinks. CBC Section 11B-606.5

PART 2 - PRODUCTS

2.1 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

- A. Lavatory: Wheelchair, vitreous china, wall mounted.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard America.
 - b. Crane Plumbing, L.L.C.
 - c. FNW; Ferguson Enterprises, Inc.
 - d. Gerber Plumbing Fixtures LLC.
 - e. Kohler Co.
 - f. Mansfield Plumbing Products LLC.
 - g. Peerless Pottery Sales, Inc.

- h. Sloan Valve Company.
 - i. Zurn Industries, LLC.
2. Fixture:
 - a. Standard: ASME A112.19.2/CSA B45.1.
 - b. Type: Slab or wheelchair.
 - c. Nominal Size: Rectangular, 27 by 20 inches.
 - d. Faucet-Hole Punching: Three holes, 2-inch centers.
 - e. Faucet-Hole Location: Top.
 - f. Color: White.
 - g. Mounting: For concealed-arm carrier.
 3. Support: Type II, concealed-arm lavatory carrier with escutcheons. Include rectangular, steel uprights.
 4. Lavatory Mounting Height: Child Handicapped/elderly according to ICC A117.1.

2.2 SOLID-BRASS, MANUALLY OPERATED FAUCETS

- A. NSF Standard: Comply with NSF 372 for faucet materials that will be in contact with potable water.
- B. Lavatory Faucets <Insert designation>: Manual-type, single-control mixing, commercial, solid-brass valve.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard America.
 - b. Bradley Corporation.
 - c. CHG; Component Hardware Group, Inc.
 - d. Chicago Faucets; Geberit Company.
 - e. Gerber Plumbing Fixtures LLC.
 - f. Kohler Co.
 - g. T&S Brass and Bronze Works, Inc.
 - h. Zurn Industries, LLC.
 2. Standard: ASME A112.18.1/CSA B125.1.
 3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
 4. Body Type: Single hole.
 5. Body Material: Commercial, solid brass.
 6. Finish: Polished chrome plate.
 7. Maximum Flow Rate: .35 gpm.
 8. Maximum Flow: [0.25 gal.] <Insert value> per metering cycle.
 9. Mounting Type: Deck, exposed.
 10. Valve Handle(s): Push button.
 11. Spout: Rigid type.

12. Spout Outlet: Laminar flow.
13. Drain: Not part of faucet.

2.3 SOLID-BRASS, AUTOMATICALLY OPERATED LAVATORY FAUCETS

- A. NSF Standard: Comply with NSF 372 for faucet materials that will be in contact with potable water.
- B. Lavatory Faucets : Automatic-type, battery-powered, electronic-sensor-operated, , solid-brass valve.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard America.
 - b. Bradley Corporation.
 - c. Chicago Faucets; Geberit Company.
 - d. Gerber Plumbing Fixtures LLC.
 - e. Hydrotek International, Inc.
 - f. Kohler Co.
 - g. Sloan Valve Company.
 - h. Speakman Company.
 - i. Stern Engineering Ltd.
 - j. T&S Brass and Bronze Works, Inc.
 - k. Zurn Industries, LLC.
 2. Standards: ASME A112.18.1/CSA B125.1 and UL 1951.
 3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 4. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
 5. Body Type: Single hole.
 6. Body Material: Commercial, solid brass.
 7. Finish: Polished chrome plate.
 8. Maximum Flow Rate: 0.35 gpm.
 9. Mounting Type: Deck, concealed.
 10. Spout: Rigid type.
 11. Spout Outlet: Laminar flow.

2.4 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF 372 for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.

- C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.
- D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Loose key.

2.5 WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.
- C. Trap:
 - 1. Size: NPS 1-1/2 by NPS 1-1/4 .
 - 2. Material: Chrome-plated, two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch- thick brass tube to wall; and chrome-plated, brass or steel wall flange.

2.6 SUPPORTS

- A. Type II Lavatory Carrier:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg. Co.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. Wade Drains.
 - e. Watts; a Watts Water Technologies company.
 - f. Zurn Industries, LLC.
 - 2. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.
- B. Examine counters and walls for suitable conditions where lavatories will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install lavatories level and plumb according to roughing-in drawings.
- B. Install supports, affixed to building substrate, for wall-mounted lavatories.
- C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.
- D. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."
- E. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

- A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

- A. After completing installation of lavatories, inspect and repair damaged finishes.
- B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed lavatories and fittings.

END OF SECTION 224216.13

SECTION 224216.16 - COMMERCIAL SINKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Service basins.
 - 2. Utility sinks.
 - 3. Sink faucets.
 - 4. Supply fittings.
 - 5. Waste fittings.

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 sinks.
 - 2. Include rated capacities, operating characteristics and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

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

1.5 CODE REFERENCES

- A. Plumbing fixtures and accessories provided in a toilet room or bathing room required to comply with CBC Section 11B-213.2 shall comply with CBC Section 11B-213.3.
- B. All single-user toilet facilities shall be identified as Gender Neutral facilities by a door symbol that complies with CBC Sections 11B-216.8 and 11B-703.7.2.6.3 No pictogram, text or braille is required on the symbol. If tactile jamb signage is provided, the signage shall comply with the appropriate technical requirements of CBC Section 11B-703. Examples of appropriate designations are "ALL-GENDER RESTROOM", "RESTROOM" OR "UNISEX RESTROOM". DSA BU 17-01.

- C. Accessible plumbing fixtures shall comply with all the requirements in CBC Division 6.
- D. Clearance around accessible water closets and in toilet compartments shall be 60 inches minimum measured perpendicular from the side wall and 56 inches minimum measured perpendicular from the side wall and 56 inches minimum measured perpendicular from the rear wall per CBC Section 11B-604.3.1.
- E. Heights and location of all accessible fixtures shall be mounted according to CBC Sections 11B-602 through 11B-612.
- F. Accessible fixture controls shall comply with CBC Sections 11B-602.3 for drinking fountains, 11B-604.6 for water closets, 11B-604.9.5 for 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.
- G. 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 11B606.3 and 11B-606.7
- H. Water supply and drain pipes under accessible lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under accessible lavatories and sinks. CBC Section 11B-606.5

PART 2 - PRODUCTS

2.1 SERVICE BASINS

- A. Service Basins: Terrazzo, floor mounted.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acorn Engineering Company.
 - b. Crane Plumbing, L.L.C.
 - c. Florestone Products Co., Inc.
 - d. Stern-Williams Co., Inc.
 - 2. Fixture:
 - a. Standard: IAPMO PS 99.
 - b. Shape: Square.
 - c. Nominal Size: 30 by 30 inches.
 - d. Height: 12 inches 12 inches with dropped front.
 - e. Tiling Flange: On two sides.
 - f. Rim Guard: On all top surfaces.
 - g. Drain: Grid with NPS 3 outlet.

3. Mounting: On floor and flush to wall.

2.2 UTILITY SINKS

A. Utility Sinks : Stainless steel, counter mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Tabco.
 - b. Elkay Manufacturing Co.
 - c. Griffin Products, Inc.
 - d. Just Manufacturing.
2. Fixture:
 - a. Standard: ASME A112.19.3/CSA B45.4.
 - b. Type: Ledge back.
 - c. Number of Compartments: One.
 - d. Overall Dimensions: .
 - e. Metal Thickness: 0.050 inch.
 - f. Compartment:
 - 1) Drain: Grid with NPS 1-1/2 tailpiece and twist drain Insert drain.
 - 2) Drain Location: Centered in compartment.
3. Faucet(s):
 - a. Number Required: One.
 - b. Mounting: On ledge.
4. Supply Fittings:
 - a. Standard: ASME A112.18.1/CSA B125.1.
 - b. Supplies: Chrome-plated brass compression stop with inlet connection matching water-supply piping type and size.
 - 1) Operation: Loose key.
 - 2) Risers: NPS 1/2, chrome-plated, soft-copper flexible tube.
5. Waste Fittings:
 - a. Standard: ASME A112.18.2/CSA B125.2.
 - b. Trap(s):
 - 1) Size: NPS 1-1/2.
 - 2) Material: Chrome-plated, two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch- thick brass tube to wall; and chrome-plated brass or steel wall flange.

6. Mounting: On counter with sealant.

2.3 SINK FAUCETS

- A. NSF Standard: Comply with NSF 372 for faucet-spout materials that will be in contact with potable water.
- B. Sink Faucets: Manual type, single control mixing valve.
 1. Commercial, Solid-Brass Faucets:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) American Standard America.
 - 2) Bradley Corporation.
 - 3) Chicago Faucets; Geberit Company.
 - 4) Delta Faucet Company.
 - 5) Elkay Manufacturing Co.
 - 6) GROHE America, Inc.
 - 7) Just Manufacturing.
 - 8) Kohler Co.
 - 9) Moen Incorporated.
 - 10) Sloan Valve Company.
 - 11) Speakman Company.
 - 12) T&S Brass and Bronze Works, Inc.
 - 13) Zurn Industries, LLC.
 2. Standard: ASME A112.18.1/CSA B125.1.
 3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
 4. Body Type: Single hole.
 5. Body Material: Commercial, solid brass.
 6. Finish: Chrome plated.
 7. Maximum Flow Rate: 1.5 gpm.
 8. Handle(s): Lever.
 9. Mounting Type: Deck, exposed .
 10. Spout Type: Rigid, solid brass.
 11. Spout Outlet: Laminar flow.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.

- B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install sinks level and plumb according to roughing-in drawings.
- B. Install supports, affixed to building substrate, for wall-hung sinks.
- C. Set floor-mounted sinks in leveling bed of cement grout.
- D. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

- A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

- A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

- A. After completing installation of sinks, inspect and repair damaged finishes.
- B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed sinks and fittings.

END OF SECTION 224216.16

SECTION 224700 - DRINKING FOUNTAINS AND WATER COOLERS

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 water coolers and related components:
 - 1. Pressure water coolers.

1.3 DEFINITIONS

- A. Accessible Water Cooler: Fixture that can be approached and used by people with disabilities.
- B. Cast Polymer: Dense, cast-filled-polymer plastic.
- C. Fitting: Device that controls flow of water into or out of fixture.
- D. Fixture: Drinking fountain or water cooler unless one is specifically indicated.
- E. Water Cooler: Electrically powered fixture for generating and delivering cooled drinking water.

1.4 SUBMITTALS

- A. Product Data: For each fixture indicated. Include rated capacities, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and Maintenance Data: For fixtures to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for fixtures for people with disabilities.
- B. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- C. ARI Standard: Comply with ARI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with ARI's "Directory of Certified Drinking Water Coolers" for type and style classifications.
- D. ASHRAE Standard: Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant, unless otherwise indicated.

1.6 CODE REFERENCES

- A. Plumbing fixtures and accessories provided in a toilet room or bathing room required to comply with CBC Section 11B-213.2 shall comply with CBC Section 11B-213.3.
- B. All single-user toilet facilities shall be identified as Gender Neutral facilities by a door symbol that complies with CBC Sections 11B-216.8 and 11B-703.7.2.6.3 No pictogram, text or braille is required on the symbol. If tactile jamb signage is provided, the signage shall comply with the appropriate technical requirements of CBC Section 11B-703. Examples of appropriate designations are "ALL-GENDER RESTROOM", "RESTROOM" OR "UNISEX RESTROOM". DSA BU 17-01.
- C. Accessible plumbing fixtures shall comply with all the requirements in CBC Division 6.
- D. Clearance around accessible water closets and in toilet compartments shall be 60 inches minimum measured perpendicular from the side wall and 56 inches minimum measured perpendicular from the side wall and 56 inches minimum measured perpendicular from the rear wall per CBC Section 11B-604.3.1.
- E. Heights and location of all accessible fixtures shall be mounted according to CBC Sections 11B-602 through 11B-612.
- F. Accessible fixture controls shall comply with CBC Sections 11B-602.3 for drinking fountains, 11B-604.6 for water closets, 11B-604.9.5 for 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.
- G. 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 11B606.3 and 11B-606.7

- H. Water supply and drain pipes under accessible lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under accessible lavatories and sinks. CBC Section 11B-606.5

PART 2 - PRODUCTS

2.1 PRESSURE WATER COOLERS

A. Water Coolers:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Elkay Manufacturing Co.
 - b. Halsey Taylor.
 - c. Haws Corporation.
 - d. Oasis Corporation.
 - e. Sunroc Corp.
 - f. Murdock Corporation.
2. Description: Accessible, ARI 1010, Type PB, pressure with bubbler, Style W, wall-mounting water cooler for adult -mounting height.
 - a. Cabinet: Bilevel with two attached cabinets and with bilevel skirt kit, all stainless steel.
 - b. Bubbler: One, with adjustable stream regulator, located on each cabinet deck.
 - c. Bottle Filler: Integral Pushbutton Bottle Filler, NSF 42+53, 1500 gallon capacity filter.
 - d. Control: Push button.
 - e. Supply: NPS 3/8 with ball, gate, or globe valve.
 - f. Drain(s): Grid with NPS 1-1/4 minimum horizontal waste and trap complying with ASME A112.18.1.
 - g. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
 - 1) Capacity: 8 gph of 50 deg F cooled water from 80 deg F inlet water and 90 deg F ambient air temperature.
 - 2) Electrical Characteristics: 335 Watt hp; 120-V ac; single phase; 60 Hz.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before fixture installation. Verify that sizes and locations of piping and types of supports match those indicated.
- B. Examine walls and floors for suitable conditions where fixtures are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Use mounting frames for recessed water coolers, unless otherwise indicated.
- B. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view. Plain copper tube, fittings, and valves may be used in concealed locations.

3.3 INSTALLATION

- A. Install mounting frames affixed to building construction and attach recessed water coolers to mounting frames, unless otherwise indicated.
- B. Install fixtures level and plumb. For fixtures indicated for children, install at height required by authorities having jurisdiction.
- C. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Use ball, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- D. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.
- E. Install pipe escutcheons at wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding pipe fittings. Escutcheons are specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.4 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

3.5 FIELD QUALITY CONTROL

- A. Water Cooler Testing: After electrical circuitry has been energized, test for compliance with requirements. Test and adjust controls and safeties.
 - 1. Remove and replace malfunctioning units and retest as specified above.
 - 2. Report test results in writing.

3.6 ADJUSTING

- A. Adjust fixture flow regulators for proper flow and stream height.

3.7 CLEANING

- A. After completing fixture installation, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

END OF SECTION 224700

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.
- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - 3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

2.2 MATERIALS

- A. Aluminum: ASTM B 221.
- B. Carbon Steel: ASTM A 1011/A 1011M.
- C. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; galvanized.
- D. Stainless Steel: ASTM A 240/A 240M.
- E. Threaded Rods: Continuously threaded. Zinc-plated or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar materials as rods.
- F. Grout: ASTM C 1107/C 1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- C. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- D. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- E. Install lateral bracing with pipe hangers and supports to prevent swaying.
- F. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- G. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- H. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- I. Insulated Piping:

1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
2. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
3. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
4. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for .
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

- B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.

END OF SECTION 230529

SECTION 230548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Seismic-restraint accessories.

1.3 DEFINITIONS

- A. IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.
- C. OSHPD: Office of Statewide Health Planning & Development (for the State of California).

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Wind-Restraint Loading:
 - 1. Basic Wind Speed: 103 MPH.
 - 2. Building Classification Category: III.
 - 3. Minimum 10 lb/sq. ft. multiplied by maximum area of HVAC component projected on vertical plane normal to wind direction, and 45 degrees either side of normal.
- B. Seismic-Restraint Loading:
 - 1. Site Class as Defined in the IBC: D.
 - 2. Assigned Seismic Use Group or Building Category as Defined in the IBC: III.
 - a. Component Importance Factor: 1.0.
 - b. Component Response Modification Factor: 1.5 ASCE Table 13.6-1, ASCE 7-16.

- c. Component Amplification Factor: ASCE Table 13.6-1, ASCE 7-16..
- 3. Design Spectral Response Acceleration at Short Periods (0.2 Second): 1.347.
- 4. Design Spectral Response Acceleration at 1.0-Second Period: 0.812.
- 5. Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
 - a. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least \geq times the maximum seismic forces to which they are subjected.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic- and wind-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."
- B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

- C. Comply with requirements in Section 077200 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
- D. Equipment Restraints:
 - 1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
 - 2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
 - 3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- E. Piping Restraints:
 - 1. Comply with requirements in MSS SP-127.
 - 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 - 3. Brace a change of direction longer than 12 feet.
- F. Install cables so they do not bend across edges of adjacent equipment or building structure.
- G. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- H. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- I. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- J. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- K. Drilled-in Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.

4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 232113 "Hydronic Piping" for piping flexible connections.

3.5 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

3.6 VIBRATION ISOLATION EQUIPMENT BASES INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."

END OF SECTION 230548

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Duct labels.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Brady Corporation.
 - b. Brimar Industries, Inc.
 - c. Carlton Industries, LP.
 - d. Champion America.
 - e. Craftmark Identification Systems.
 - f. emedco.
 - g. Kolbi Pipe Marker Co.
 - h. LEM Products Inc.
 - i. Marking Services Inc.
 - j. Seton Identification Products.
 - 2. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 3. Letter Color: Blue.
 - 4. Background Color: Black.
 - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Brady Corporation.
 - b. Brimar Industries, Inc.
 - c. Carlton Industries, LP.
 - d. Champion America.
 - e. Craftmark Identification Systems.
 - f. emedco.
 - g. Kolbi Pipe Marker Co.
 - h. LEM Products Inc.
 - i. Marking Services Inc.
 - j. Seton Identification Products.
2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
3. Letter Color: Blue.
4. Background Color: White.
5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
7. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
8. Fasteners: Stainless-steel rivets or self-tapping screws.
9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 DUCT LABELS

- 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. Brady Corporation.
 - 2. Brimar Industries, Inc.
 - 3. Carlton Industries, LP.
 - 4. Champion America.
 - 5. Craftmark Identification Systems.
 - 6. emedco.
 - 7. Kolbi Pipe Marker Co.
 - 8. LEM Products Inc.
 - 9. Marking Services Inc.
 - 10. Seton Identification Products.
- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- C. Letter Color: Blue.
- D. Background Color: White.
- E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- H. Fasteners: Stainless-steel rivets or self-tapping screws.
- I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- J. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings; also include duct size and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions or as separate unit on each duct label to indicate flow direction.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.4 DUCT LABEL INSTALLATION

- A. Install [plastic-laminated] [self-adhesive] duct labels with permanent adhesive on air ducts in the following color codes:
 - 1. Blue: For cold-air supply ducts.
 - 2. Yellow: For hot-air supply ducts.
 - 3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
- B. Stenciled Duct Label Option: Stenciled labels showing service and flow direction may be provided instead of plastic-laminated duct labels, at Installer's option.
- C. Locate labels near points where ducts enter into and exit from concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Balancing Air Systems:
 - a. Constant-volume air systems.
 - 2. Duct leakage tests.

1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. BAS: Building automation systems.
- C. NEBB: National Environmental Balancing Bureau.
- D. TAB: Testing, adjusting, and balancing.
- E. TABB: Testing, Adjusting, and Balancing Bureau.
- F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
- G. TDH: Total dynamic head.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Certified TAB reports.
- C. Sample report forms.

D. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.5 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by AABC.

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
2. TAB Technician: Employee of the TAB specialist and certified by AABC as a TAB technician.

B. TAB Specialists Qualifications: Certified by NEBB or TABB.

1. TAB Field Supervisor: Employee of the TAB specialist and certified by NEBB or TABB.
2. TAB Technician: Employee of the TAB specialist and certified by NEBB or TABB as a TAB technician.

1.6 FIELD CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

- B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine equipment performance data including fan and pump curves.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
- J. Examine operating safety interlocks and controls on HVAC equipment.
- K. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes the following:
 - 1. Equipment and systems to be tested.
 - 2. Strategies and step-by-step procedures for balancing the systems.
 - 3. Instrumentation to be used.
 - 4. Sample forms with specific identification for all equipment.

- B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
 - 1. Airside:
 - a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
 - b. Duct systems are complete with terminals installed.
 - c. Volume, smoke, and fire dampers are open and functional.
 - d. Clean filters are installed.
 - e. Fans are operating, free of vibration, and rotating in correct direction.
 - f. Variable-frequency controllers' startup is complete and safeties are verified.
 - g. Automatic temperature-control systems are operational.
 - h. Ceilings are installed.
 - i. Windows and doors are installed.
 - j. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 - 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
 - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," and Section 230719 "HVAC Piping Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check dampers for proper position to achieve desired airflow path.
- H. Check for airflow blockages.
- I. Check condensate drains for proper connections and functioning.
- J. Check for proper sealing of air-handling-unit components.
- K. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
 - b. Where duct conditions allow, measure airflow by main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses, close to the fan and prior to any outlets, to obtain total airflow.
 - c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
 - 2. Measure fan static pressures as follows:
 - a. Measure static pressure directly at the fan outlet or through the flexible connection.
 - b. Measure static pressure directly at the fan inlet or through the flexible connection.
 - c. Measure static pressure across each component that makes up the air-handling system.
 - d. Report artificial loading of filters at the time static pressures are measured.
 - 3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.

4. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
1. Measure airflow of submain and branch ducts.
 2. Adjust submain and branch duct volume dampers for specified airflow.
 3. Re-measure each submain and branch duct after all have been adjusted.
- C. Adjust air inlets and outlets for each space to indicated airflows.
1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
 2. Measure inlets and outlets airflow.
 3. Adjust each inlet and outlet for specified airflow.
 4. Re-measure each inlet and outlet after they have been adjusted.
- D. Verify final system conditions.
1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
 2. Re-measure and confirm that total airflow is within design.
 3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
 4. Mark all final settings.
 5. Test system in economizer mode. Verify proper operation and adjust if necessary.
 6. Measure and record all operating data.
 7. Record final fan-performance data.
- 3.6 PROCEDURES FOR CONDENSING UNITS
- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record fan and motor operating data.
- 3.7 DUCT LEAKAGE TESTS
- A. Witness the duct pressure testing performed by Installer.

- B. Verify that proper test methods are used and that leakage rates are within specified tolerances.
- C. Report deficiencies observed.

3.8 TOLERANCES

- A. Set HVAC system's airflow rates and water flow rates within the following tolerances:
 - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
 - 2. Air Outlets and Inlets: Plus or minus 10 percent.
- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.9 PROGRESS REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: Prepare monthly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.10 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
 - 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 - 2. Include a list of instruments used for procedures, along with proof of calibration.
 - 3. Certify validity and accuracy of field data.
- B. Final Report Contents: In addition to certified field-report data, include the following:
 - 1. Fan curves.
 - 2. Manufacturers' test data.
 - 3. Field test reports prepared by system and equipment installers.
 - 4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

- C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
 2. Name and address of the TAB specialist.
 3. Project name.
 4. Project location.
 5. Architect's name and address.
 6. Engineer's name and address.
 7. Contractor's name and address.
 8. Report date.
 9. Signature of TAB supervisor who certifies the report.
 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 12. Nomenclature sheets for each item of equipment.
 13. Data for terminal units, including manufacturer's name, type, size, and fittings.
 14. Notes to explain why certain final data in the body of reports vary from indicated values.
 15. Test conditions for fans performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Settings for supply-air, static-pressure controller.
 - g. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
 2. Duct, outlet, and inlet sizes.
 3. Pipe and valve sizes and locations.
 4. Position of balancing devices.
- E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data:
 - a. Unit identification.
 - b. Location.

- c. Make and type.
- d. Model number and unit size.
- e. Manufacturer's serial number.
- f. Unit arrangement and class.
- g. Discharge arrangement.
- h. Sheave make, size in inches, and bore.
- i. Center-to-center dimensions of sheave and amount of adjustments in inches.
- j. Number, make, and size of belts.
- k. Number, type, and size of filters.

2. Motor Data:

- a. Motor make, and frame type and size.
- b. Horsepower and rpm.
- c. Volts, phase, and hertz.
- d. Full-load amperage and service factor.
- e. Sheave make, size in inches, and bore.
- f. Center-to-center dimensions of sheave and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

- a. Total airflow rate in cfm.
- b. Total system static pressure in inches wg.
- c. Fan rpm.
- d. Discharge static pressure in inches wg.
- e. Filter static-pressure differential in inches wg.
- f. Cooling-coil static-pressure differential in inches wg.
- g. Heating-coil static-pressure differential in inches wg.
- h. Outdoor airflow in cfm.
- i. Return airflow in cfm.
- j. Outdoor-air damper position.
- k. Return-air damper position.
- l. Vortex damper position.

F. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

- a. System identification.
- b. Location.
- c. Make and type.
- d. Model number and size.
- e. Manufacturer's serial number.
- f. Arrangement and class.
- g. Sheave make, size in inches, and bore.
- h. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 - g. Number, make, and size of belts.
3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Suction static pressure in inches wg.

G. Round and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:
 - a. System and air-handling-unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F.
 - d. Duct static pressure in inches wg.
 - e. Duct size in inches.
 - f. Duct area in sq. ft..
 - g. Indicated airflow rate in cfm.
 - h. Indicated velocity in fpm.
 - i. Actual airflow rate in cfm.
 - j. Actual average velocity in fpm.
 - k. Barometric pressure in psig.

H. Air-Terminal-Device Reports:

1. Unit Data:
 - a. System and air-handling unit identification.
 - b. Location and zone.
 - c. Apparatus used for test.
 - d. Area served.
 - e. Make.
 - f. Number from system diagram.
 - g. Type and model number.
 - h. Size.
 - i. Effective area in sq. ft..

2. Test Data (Indicated and Actual Values):
 - a. Airflow rate in cfm.
 - b. Air velocity in fpm.
 - c. Preliminary airflow rate as needed in cfm.
 - d. Preliminary velocity as needed in fpm.
 - e. Final airflow rate in cfm.
 - f. Final velocity in fpm.
 - g. Space temperature in deg F.

I. Instrument Calibration Reports:

1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.11 VERIFICATION OF TAB REPORT

- A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Architect.
- B. Architect shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
- C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
- D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
- E. If TAB work fails, proceed as follows:
 1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
 2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
 3. If the second verification also fails, design professional may contact AABC Headquarters regarding the AABC National Performance Guaranty.

- F. Prepare test and inspection reports.

3.12 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 230713 - DUCT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes insulating the following duct services:
 - 1. Indoor, concealed supply and outdoor air.
 - 2. Indoor, concealed return located in unconditioned space.
- B. Related Sections:
 - 1. Section 230719 "HVAC Piping Insulation."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSP jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corporation.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Knauf Insulation.

- d. Manson Insulation Inc.
 - e. Owens Corning.
- D. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corporation.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Knauf Insulation.
 - d. Manson Insulation Inc.
 - e. Owens Corning.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
 - a. Aeroflex USA, Inc.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Mon-Eco Industries, Inc.
 - 2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
- C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand; H. B. Fuller Construction Products.

- b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Mon-Eco Industries, Inc.
2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

2.3 MASTICS AND COATINGS

- A. Materials shall be compatible with insulation materials, jackets, and substrates.
- 1. VOC Content: 300 g/L or less.
 - 2. Low-Emitting Materials: Mastic coatings shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
- B. Vapor-Retarder Mastic: Water based; suitable for indoor use on below ambient services.
- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Foster Brand; H. B. Fuller Construction Products.
 - c. Knauf Insulation.
 - d. Vimasco Corporation.
 - 2. Water-Vapor Permeance: Comply with ASTM C 755, Section 7.2.2, Table 2, for insulation type and service conditions.
 - 3. Service Temperature Range: Minus 20 to plus 180 deg F.

2.4 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Foster Brand; H. B. Fuller Construction Products.
 - c. Vimasco Corporation.

2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

2.5 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Mon-Eco Industries, Inc.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.
 - a. P.I.C. Plastics, Inc.

2.7 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division.
 - b. Compac Corporation.
 - c. Ideal Tape Co., Inc., an American Biltrite Company.
 - d. Knauf Insulation.
 - e. Venture Tape.
 2. Width: 3 inches.
 3. Thickness: 11.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division.
 - b. Compac Corporation.
 - c. Ideal Tape Co., Inc., an American Biltrite Company.
 - d. Knauf Insulation.
 - e. Venture Tape.
 2. Width: 3 inches.
 3. Thickness: 6.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division.
 - b. Compac Corporation.
 - c. Ideal Tape Co., Inc., an American Biltrite Company.

- d. Knauf Insulation.
 - e. Venture Tape.
2. Width: 2 inches.
 3. Thickness: 3.7 mils.
 4. Adhesion: 100 ounces force/inch in width.
 5. Elongation: 5 percent.
 6. Tensile Strength: 34 lbf/inch in width.

2.8 SECUREMENTS

A. Bands:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ITW Insulation Systems; Illinois Tool Works, Inc.
 - b. RPR Products, Inc.
2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 ; 0.015 inch thick, 1/2 inch wide with wing seal or closed seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 - a. 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) AGM Industries, Inc.
 - 2) Gemco.
 - 3) Hardcast, Inc.
 - 4) Midwest Fasteners, Inc.
 - 5) Nelson Stud Welding.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

- a. 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) AGM Industries, Inc.
 - 2) Gemco.
 - 3) Midwest Fasteners, Inc.
 - 4) Nelson Stud Welding.
- 3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. 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) AGM Industries, Inc.
 - 2) Gemco.
 - 3) Midwest Fasteners, Inc.
 - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
- 4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. 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) Gemco.
 - 2) Midwest Fasteners, Inc.
 - b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
 - c. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. 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) AGM Industries, Inc.
 - 2) Gemco.
 - 3) Midwest Fasteners, Inc.
 - b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive-backed base with a peel-off protective cover.
6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. 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) AGM Industries, Inc.
 - 2) Gemco.
 - 3) Midwest Fasteners, Inc.
 - 4) Nelson Stud Welding.
 - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- D. Wire: 0.062-inch soft-annealed, stainless steel.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. C & F Wire.
 - b. Or Equal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

- C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for [100] [50] <Insert number> percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.6 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- C. Do not field paint aluminum or stainless-steel jackets.

3.7 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
 1. Indoor, concealed supply and outdoor air.
 2. Indoor, concealed return located in unconditioned space.
- B. Items Not Insulated:
 1. Fibrous-glass ducts.
 2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
 3. Factory-insulated flexible ducts.
 4. Factory-insulated plenums and casings.
 5. Flexible connectors.
 6. Vibration-control devices.
 7. Factory-insulated access panels and doors.

3.8 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, round, supply-air duct insulation shall be one of the following:
 1. Mineral-Fiber Blanket: 1-1/2 inches thick and 1.5-lb/cu. ft. nominal density.

- B. Concealed, round, return-air duct insulation shall be one of the following:
 - 1. Mineral-Fiber Blanket: 1-1/2 inches thick and 1.5-lb/cu. ft. nominal density.
- C. Concealed, rectangular, supply-air duct insulation shall be one of the following:
 - 1. Mineral-Fiber Blanket: 1-1/2 inches thick and 1.5-lb/cu. ft. nominal density.
- D. Concealed, rectangular, return-air duct insulation shall be one of the following:
 - 1. Mineral-Fiber Blanket: 1-1/2 inches thick and 1.5-lb/cu. ft. nominal density.
- E. Concealed, supply-air plenum insulation shall be one of the following:
 - 1. Mineral-Fiber Blanket: 1-1/2 inches thick and 1.5-lb/cu. ft. nominal density.
- F. Concealed, return-air and relief air duct or plenum insulation shall be one of the following:
 - 1. Mineral-Fiber Blanket: 1-1/2 inches thick and 1.5-lb/cu. ft. nominal density.

END OF SECTION 230713

SECTION 230719 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes insulation for HVAC piping systems.
- B. Related Sections:
 - 1. Section 230713 "Duct Insulation" for duct insulation.

1.3 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.5 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.6 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come into contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable in accordance with ASTM C795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534/C534M, Type I for tubular materials, Type II for sheet materials.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Aeroflex USA, Inc.
 - b. Armacell LLC.
 - c. K-Flex USA.
- G. Mineral-Fiber, Preformed Pipe: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C547.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. Knauf Insulation.
 - c. Manson Insulation Inc.
 - d. Owens Corning.
2. Preformed Pipe Insulation: Type I, Grade A, without factory-applied jacket with factory-applied ASJ with factory-applied ASJ-SSL.
3. 850 deg F.
4. Factory fabricate shapes in accordance with ASTM C450 and ASTM C585.
5. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - a. ITW Insulation Systems; Illinois Tool Works, Inc.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
 - a. Mon-Eco Industries, Inc.
- B. Flexible Elastomeric and Polyolefin Adhesive: Solvent-based adhesive.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Aeroflex USA, Inc.
 - b. Armacell LLC.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. K-Flex USA.
 2. Adhesive: As recommended by flexible elastomeric and polyolefin manufacturer and with a VOC content of 80 g/L or less.
 3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 4. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 5. Flame-spread index shall be 25 or less and smoke-developed index shall be 50 or less as tested in accordance with ASTM E84.
 6. Wet Flash Point: Below 0 deg F.

7. Service Temperature Range: 40 to 200 deg F.
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Foster Brand; H. B. Fuller Construction Products.
 - c. Mon-Eco Industries, Inc.
 2. Adhesive: As recommended by mineral fiber manufacturer and with a VOC content of [80] <Insert value> g/L or less.
 3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 4. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- D. ASJ Adhesive and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A, for bonding insulation jacket lap seams and joints.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Foster Brand; H. B. Fuller Construction Products.
 - c. Mon-Eco Industries, Inc.
 2. Adhesives shall have a VOC content of [50] <Insert value> g/L or less.
 3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 4. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - a. P.I.C. Plastics, Inc.

2.3 MASTICS AND COATINGS

- A. Materials shall be compatible with insulation materials, jackets, and substrates.
1. Mastics: As recommended by insulation manufacturer and with a VOC content of [50] <Insert value> g/L or less.
 2. Mastics shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 3. Mastics shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 4. Mastics shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.
- B. Vapor-Retarder Mastic, Water Based: Suitable for indoor use on below-ambient services.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Foster Brand; H. B. Fuller Construction Products.
 - c. Knauf Insulation.
 - d. Vimasco Corporation.
 2. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
 3. Comply with MIL-PRF-19565C, Type II, for permeance requirements[, with supplier listing on DOD QPD - Qualified Products Database].
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Foster Brand; H. B. Fuller Construction Products.
 - c. Knauf Insulation.
 - d. Mon-Eco Industries, Inc.
 - e. Vimasco Corporation.

2. Water-Vapor Permeance: ASTM E96/E96M, greater than 1.0 perm at manufacturer's recommended dry film thickness.

2.4 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.
 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.

2.5 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C1136, Type I, unless otherwise indicated.
- B. Metal Jacket:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ITW Insulation Systems; Illinois Tool Works, Inc.
 - b. RPR Products, Inc.
 - c. Insert manufacturer's name.
 2. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. Sheet and roll stock ready for shop or field sizing.
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper 3-mil- thick, heat-bonded polyethylene and kraft paper 2.5-mil- thick polysurlyn.
 - d. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper 2.5-mil- thick polysurlyn.
 - e. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) Tee covers.
 - 4) Flange and union covers.
 - 5) End caps.
 - 6) Beveled collars.
 - 7) Valve covers.

- 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.6 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. 3M Industrial Adhesives and Tapes Division.
 - b. Avery Dennison Corporation, Specialty Tapes Division.
 - c. Ideal Tape Co., Inc., an American Biltrite Company.
 - d. Knauf Insulation.
 2. Width: 3 inches Insert value.
 3. Thickness: 11.5 mils Insert value.
 4. Adhesion: 90 ounces force/inch Insert value in width.
 5. Elongation: 2 Insert number percent.
 6. Tensile Strength: 40 lbf/inch Insert value in width.
 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. 3M Industrial Adhesives and Tapes Division.
 - b. Avery Dennison Corporation, Specialty Tapes Division.
 - c. Ideal Tape Co., Inc., an American Biltrite Company.
 - d. Knauf Insulation.
 2. Width: 3 inches Insert value.
 3. Thickness: 6.5 mils Insert value.
 4. Adhesion: 90 ounces force/inch Insert value in width.
 5. Elongation: 2 Insert number percent.
 6. Tensile Strength: 40 lbf/inch Insert value in width.
 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 - 1. Carbon Steel: Coat carbon steel operating at a service temperature of between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.

- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
 - 3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 2 inches o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 25 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least [4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.
- P. For above-ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:
 - 1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as that of adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 - 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 - 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers, so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 - 6. Insulate flanges, mechanical couplings, and unions using a section of oversized preformed pipe insulation to fit. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
 - 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 - 8. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
 - 1. Install pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as that of pipe insulation.
 - 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install mitered sections of pipe insulation.
 - 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install preformed valve covers manufactured of same material as that of pipe insulation when available.
 - 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - 3. Install insulation to flanges as specified for flange insulation application.
 - 4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 FIELD-APPLIED JACKET INSTALLATION

- A. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches o.c. and at end joints.

3.8 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless steel jackets.

3.9 PIPING INSULATION SCHEDULE, GENERAL

- A. Insulation conductivity and thickness per pipe size shall comply with schedules in this Section or with requirements of authorities having jurisdiction, whichever is more stringent.
- B. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- C. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 1. Underground piping.
 2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.10 INDOOR PIPING INSULATION SCHEDULE

- A. Condensate and Equipment Drain Water below 60 Deg F:
 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 3/4 inch thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
- B. Refrigerant Suction and Hot-Gas Piping:
 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- C. Refrigerant Suction and Hot-Gas Flexible Tubing:
 1. All Pipe Sizes: Insulation shall be one of the following:

- a. Flexible Elastomeric: 2 inches thick.
- D. Refrigerant Liquid Piping:
 - 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

3.11 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

- A. Refrigerant Suction and Hot-Gas Piping:
 - 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 2 inches thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.
- B. Refrigerant Suction and Hot-Gas Flexible Tubing:
 - 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 2 inches thick.
- C. Refrigerant Liquid Piping:
 - 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch thick.

3.12 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
 - 1. Aluminum, Corrugated: 0.016 inch thick.
- D. Piping, Exposed:
 - 1. Aluminum, Corrugated: 0.016 inch thick.

END OF SECTION 230719

SECTION 230923 - DIRECT DIGITAL CONTROL (DDC) SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. DDC system for monitoring and controlling of HVAC systems.
 - 2. Delivery of selected control devices to equipment and systems manufacturers for factory installation and to HVAC systems installers for field installation.
- B. Related Requirements:
 - 1. Communications Cabling:
 - a. Section 270100 "Communications General Provisions" for balanced twisted pair communications cable.
 - 2. Section 260100 "Electrical General Provisions" Article 18 for identification requirements for electrical components.

1.3 DEFINITIONS

- A. Algorithm: A logical procedure for solving a recurrent mathematical problem. A prescribed set of well-defined rules or processes for solving a problem in a finite number of steps.
- B. Analog: A continuously varying signal value, such as current, flow, pressure, or temperature.
- C. BACnet Specific Definitions:
 - 1. BACnet: Building Automation Control Network Protocol, ASHRAE 135. A communications protocol allowing devices to communicate data over and services over a network.
 - 2. BACnet Interoperability Building Blocks (BIBBs): BIBB defines a small portion of BACnet functionality that is needed to perform a particular task. BIBBs are combined to build the BACnet functional requirements for a device.

3. BACnet/IP: Defines and allows using a reserved UDP socket to transmit BACnet messages over IP networks. A BACnet/IP network is a collection of one or more IP subnetworks that share the same BACnet network number.
- D. Binary: Two-state signal where a high signal level represents "ON" or "OPEN" condition and a low signal level represents "OFF" or "CLOSED" condition. "Digital" is sometimes used interchangeably with "Binary" to indicate a two-state signal.
- E. Controller: Generic term for any standalone, microprocessor-based, digital controller residing on a network, used for local or global control. Three types of controllers are indicated: Network Controller, Programmable Application Controller, and Application-Specific Controller.
- F. Control System Integrator: An entity that assists in expansion of existing enterprise system and support of additional operator interfaces to I/O being added to existing enterprise system.
- G. COV: Changes of value.
- H. DDC System Provider: Authorized representative of, and trained by, DDC system manufacturer and responsible for execution of DDC system Work indicated.
- I. Distributed Control: Processing of system data is decentralized and control decisions are made at subsystem level. System operational programs and information are provided to remote subsystems and status is reported back. On loss of communication, subsystems shall be capable of operating in a standalone mode using the last best available data.
- J. DOCSIS: Data-Over Cable Service Interface Specifications.
- K. E/P: Voltage to pneumatic.
- L. Gateway: Bidirectional protocol translator that connects control systems that use different communication protocols.
- M. HLC: Heavy load conditions.
- N. I/O: System through which information is received and transmitted. I/O refers to analog input (AI), binary input (BI), analog output (AO) and binary output (BO). Analog signals are continuous and represent control influences such as flow, level, moisture, pressure, and temperature. Binary signals convert electronic signals to digital pulses (values) and generally represent two-position operating and alarm status. "Digital," (DI and (DO), is sometimes used interchangeably with "Binary," (BI) and (BO), respectively.
- O. I/P: Current to pneumatic.
- P. LAN: Local area network.
- Q. LNS: LonWorks Network Services.

- R. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.
- S. Mobile Device: A data-enabled phone or tablet computer capable of connecting to a cellular data network and running a native control application or accessing a web interface.
- T. Modbus TCP/IP: An open protocol for exchange of process data.
- U. MS/TP: Master-slave/token-passing, IEE 8802-3. Datalink protocol LAN option that uses twisted-pair wire for low-speed communication.
- V. MTBF: Mean time between failures.
- W. Network Controller: Digital controller, which supports a family of programmable application controllers and application-specific controllers, that communicates on peer-to-peer network for transmission of global data.
- X. Network Repeater: Device that receives data packet from one network and rebroadcasts it to another network. No routing information is added to protocol.
- Y. Peer to Peer: Networking architecture that treats all network stations as equal partners.
- Z. POT: Portable operator's terminal.
- AA. PUE: Performance usage effectiveness.
- BB. RAM: Random access memory.
- CC. RF: Radio frequency.
- DD. Router: Device connecting two or more networks at network layer.
- EE. Server: Computer used to maintain system configuration, historical and programming database.
- FF. TCP/IP: Transport control protocol/Internet protocol.
- GG. UPS: Uninterruptible power supply.
- HH. USB: Universal Serial Bus.
- II. User Datagram Protocol (UDP): This protocol assumes that the IP is used as the underlying protocol.
- JJ. VAV: Variable air volume.
- KK. WLED: White light emitting diode.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product include the following:

1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.
3. Product description with complete technical data, performance curves, and product specification sheets.
4. Installation, operation and maintenance instructions including factors effecting performance.
5. Bill of materials of indicating quantity, manufacturer, and extended model number for each unique product.
 - a. Servers.
 - b. Protocol analyzers.
 - c. DDC controllers.
 - d. Enclosures.
 - e. Electrical power devices.
 - f. Instruments.
6. When manufacturer's product datasheets apply to a product series rather than a specific product model, clearly indicate and highlight only applicable information.
7. Each submitted piece of product literature shall clearly cross reference specification and drawings that submittal is to cover.

B. Shop Drawings:

1. General Requirements:
 - a. Include cover drawing with Project name, location, Owner, Architect, Contractor and issue date with each Shop Drawings submission.
 - b. Include a drawing index sheet listing each drawing number and title that matches information in each title block.
2. Include plans, elevations, sections, and mounting details where applicable.
3. Include details of product assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
4. Detail means of vibration isolation and show attachments to rotating equipment.
5. Plan Drawings indicating the following:
 - a. Screened backgrounds of walls, structural grid lines, HVAC equipment, ductwork and piping.

- b. Room names and numbers with coordinated placement to avoid interference with control products indicated.
 - c. Each desktop workstation, server, gateway, router, DDC controller, control panel instrument connecting to DDC controller, and damper and valve connecting to DDC controller, if included in Project.
 - d. Exact placement of products in rooms, ducts, and piping to reflect proposed installed condition.
 - e. Network communication cable and raceway routing.
 - f. Information, drawn to scale, of <Insert requirements>.
 - g. Proposed routing of wiring, cabling, conduit, and tubing, coordinated with building services for review before installation.
6. Schematic drawings for each controlled HVAC system indicating the following:
- a. I/O points labeled with point names shown. Indicate instrument range, normal operating set points, and alarm set points. Indicate fail position of each damper and valve, if included in Project.
 - b. I/O listed in table format showing point name, type of device, manufacturer, model number, and cross-reference to product data sheet number.
 - c. A graphic showing location of control I/O in proper relationship to HVAC system.
 - d. Wiring diagram with each I/O point having a unique identification and indicating labels for all wiring terminals.
 - e. Unique identification of each I/O that shall be consistently used between different drawings showing same point.
 - f. Elementary wiring diagrams of controls for HVAC equipment motor circuits including interlocks, switches, relays and interface to DDC controllers.
 - g. Narrative sequence of operation.
 - h. Graphic sequence of operation, showing all inputs and output logical blocks.
7. Control panel drawings indicating the following:
- a. Panel dimensions, materials, size, and location of field cable, raceways, and tubing connections.
 - b. Interior subpanel layout, drawn to scale and showing all internal components, cabling and wiring raceways, nameplates and allocated spare space.
 - c. Front, rear, and side elevations and nameplate legend.
 - d. Unique drawing for each panel.
8. DDC system network riser diagram indicating the following:
- a. Each device connected to network with unique identification for each.
 - b. Interconnection of each different network in DDC system.
 - c. For each network, indicate communication protocol, speed and physical means of interconnecting network devices, such as copper cable type, or optical fiber cable type. Indicate raceway type and size for each.

- d. Each network port for connection of an operator workstation or other type of operator interface with unique identification for each.
- 9. DDC system electrical power riser diagram indicating the following:
 - a. Each point of connection to field power with requirements (volts/phase/hertz/amperes/connection type) listed for each.
 - b. Each control power supply including, as applicable, transformers, power-line conditioners, transient voltage suppression and high filter noise units, DC power supplies, and UPS units with unique identification for each.
 - c. Each product requiring power with requirements (volts/phase/hertz/amperes/connection type) listed for each.
 - d. Power wiring type and size, race type, and size for each.
- 10. Monitoring and control signal diagrams indicating the following:
 - a. Control signal cable and wiring between controllers and I/O.
 - b. Point-to-point schematic wiring diagrams for each product.
 - c. Control signal tubing to sensors, switches and transmitters.
 - d. Process signal tubing to sensors, switches and transmitters.
- 11. Color graphics indicating the following:
 - a. Itemized list of color graphic displays to be provided.
 - b. For each display screen to be provided, a true color copy showing layout of pictures, graphics and data displayed.
 - c. Intended operator access between related hierarchical display screens.

C. System Description:

- 1. Full description of DDC system architecture, network configuration, operator interfaces and peripherals, servers, controller types and applications, gateways, routers and other network devices, and power supplies.
- 2. Complete listing and description of each report, log and trend for format and timing and events which initiate generation.
- 3. System and product operation under each potential failure condition including, but not limited to, the following:
 - a. Loss of power.
 - b. Loss of network communication signal.
 - c. Loss of controller signals to inputs and outpoints.
 - d. Operator workstation failure.
 - e. Server failure.
 - f. Gateway failure.
 - g. Network failure
 - h. Controller failure.
 - i. Instrument failure.
 - j. Control damper and valve actuator failure.
 - k. Insert potential failure conditions.

4. Complete bibliography of documentation and media to be delivered to Owner.
5. Description of testing plans and procedures.
6. Description of Owner training.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For DDC system to include in emergency, operation and maintenance manuals.
 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Project Record Drawings of as-built versions of submittal Shop Drawings provided in electronic PDF format.
 - b. Testing and commissioning reports and checklists of completed final versions of reports, checklists, and trend logs.
 - c. As-built versions of submittal Product Data.
 - d. Names, addresses, e-mail addresses and 24-hour telephone numbers of Installer and service representatives for DDC system and products.
 - e. Operator's manual with procedures for operating control systems including logging on and off, handling alarms, producing point reports, trending data, overriding computer control and changing set points and variables.
 - f. Programming manuals with description of programming language and syntax, of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.
 - g. Engineering, installation, and maintenance manuals that explain how to:
 - 1) Design and install new points, panels, and other hardware.
 - 2) Perform preventive maintenance and calibration.
 - 3) Debug hardware problems.
 - 4) Repair or replace hardware.
 - h. Documentation of all programs created using custom programming language including set points, tuning parameters, and object database.
 - i. Backup copy of graphic files, programs, and database on electronic media such as DVDs.
 - j. List of recommended spare parts with part numbers and suppliers.
 - k. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.
 - l. Complete original-issue copies of furnished software, including operating systems, custom programming language, operator workstation software, and graphics software.
 - m. Licenses, guarantees, and warranty documents.
 - n. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.
 - o. Owner training materials.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Include product manufacturers' recommended parts lists for proper product operation over four -year period following warranty period. Parts list shall be indicated for each year.

1.7 QUALITY ASSURANCE

- A. DDC System Provider Qualifications:
 - 1. Authorized representative of, and trained by, DDC system manufacturer.
 - 2. In-place facility located within 45 miles of Project.
 - 3. Demonstrated past experience with installation of DDC system products being installed for period within five consecutive years before time of bid.
 - 4. Demonstrated past experience on [five] <Insert number> projects of similar complexity, scope and value.
 - 5. Each person assigned to Project shall have demonstrated past experience.
 - 6. Staffing resources of competent and experienced full-time employees that are assigned to execute work according to schedule.
 - 7. Service and maintenance staff assigned to support Project during warranty period.
 - 8. Product parts inventory to support on-going DDC system operation for a period of not less than 5 years after Substantial Completion.
 - 9. DDC system manufacturer's backing to take over execution of Work if necessary to comply with requirements indicated. Include Project-specific written letter, signed by manufacturer's corporate officer, if requested.

1.8 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace products that fail in materials or workmanship within specified warranty period.
 - 1. Failures shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Owner.
 - 2. Include updates or upgrades to software and firmware if necessary to resolve deficiencies.
 - a. Install updates only after receiving Owner's written authorization.
 - 3. Warranty service shall occur during normal business hours and commence within 16 hours of Owner's warranty service request.
 - 4. Warranty Period: Two year(s) from date of Substantial Completion.
 - a. For Gateway: Three -year parts and labor warranty for each.

PART 2 - PRODUCTS

2.1 DDC SYSTEM MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Carrier i-Vu.

2.2 DDC SYSTEM DESCRIPTION

- A. Microprocessor-based monitoring and control including analog/digital conversion and program logic. A control loop or subsystem in which digital and analog information is received and processed by a microprocessor, and digital control signals are generated based on control algorithms and transmitted to field devices to achieve a set of predefined conditions.
 - 1. DDC system shall consist of a high-speed, peer-to-peer network of distributed DDC controllers, other network devices, operator interfaces, and software.
- 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.

2.3 WEB ACCESS

- A. DDC system shall be Web based.
 - 1. Web-Based Access to DDC System:
 - a. DDC system software shall be based on server thin-client architecture, designed around open standards of Web technology. DDC system server shall be accessed using a Web browser over DDC system network, using Owner's LAN, and remotely over Internet through Owner's LAN.
 - b. Intent of thin-client architecture is to provide operators complete access to DDC system via a Web browser. No special software other than a Web browser shall be required to access graphics, point displays, and trends; to configure trends, points, and controllers; and to edit programming.
 - c. Web access shall be password protected.

2.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional to design DDC system to satisfy requirements indicated.
 - 1. System Performance Objectives:

- a. DDC system shall manage HVAC systems.
 - b. DDC system control shall operate HVAC systems to achieve optimum operating costs while using least possible energy and maintaining specified performance.
 - c. DDC system shall respond to power failures, HVAC equipment failures, and adverse and emergency conditions encountered through connected I/O points.
 - d. DDC system shall operate while unattended by an operator and through operator interaction.
 - e. DDC system shall record trends and transaction of events and produce report information such as performance, energy, occupancies, and equipment operation.
- B. Surface-Burning Characteristics: Products installed in ducts, equipment, and return-air paths shall 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.
- C. DDC System Speed:
 - 1. Response Time of Connected I/O:
 - a. AI point values connected to DDC system shall be updated at least every two seconds for use by DDC controllers. Points used globally shall also comply with this requirement.
 - b. BI point values connected to DDC system shall be updated at least every two seconds for use by DDC controllers. Points used globally shall also comply with this requirement.
 - c. AO points connected to DDC system shall begin to respond to controller output commands within two second(s). Global commands shall also comply with this requirement.
 - d. BO point values connected to DDC system shall respond to controller output commands within two second(s). Global commands shall also comply with this requirement.
 - 2. Display of Connected I/O:
 - a. Analog point COV connected to DDC system shall be updated and displayed at least every 10 seconds for use by operator.
 - b. Binary point COV connected to DDC system shall be updated and displayed at least every 10 seconds for use by operator.
 - c. Alarms of analog and digital points connected to DDC system shall be displayed within 45 seconds of activation or change of state.
 - d. Graphic display refresh shall update within eight seconds.
 - e. Point change of values and alarms displayed from workstation to workstation when multiple operators are viewing from multiple workstations shall not exceed graphic refresh rate indicated.

- D. Network Bandwidth: Design each network of DDC system to include at least 30 percent available spare bandwidth with DDC system operating under normal and heavy load conditions indicated. Calculate bandwidth usage, and apply a safety factor to ensure that requirement is satisfied when subjected to testing under worst case conditions.
- E. DDC System Data Storage:
1. Include capability to archive not less than 24 consecutive months of historical data for all I/O points connected to system, including alarms, event histories, transaction logs, trends and other information indicated.
 2. Local Storage:
 - a. Provide server with data storage indicated. Server(s) shall use IT industry standard database platforms and be capable of functions described in "DDC Data Access" Paragraph.
 3. Cloud Storage:
 - a. Provide application-based and web browser interfaces to configure, upload, download, and manage data, and service plan with storage adequate to store all data for term indicated. Cloud storage shall use IT industry standard database platforms and be capable of functions described in "DDC Data Access" Paragraph.
- F. DDC Data Access:
1. When logged into the system, operator shall be able to also interact with any DDC controller connected to DDC system as required for functional operation of DDC system.
 2. System(s) shall be used for application configuration; for archiving, reporting and trending of data; for operator transaction archiving and reporting; for network information management; for alarm annunciation; and for operator interface tasks and controls application management.
- G. Future Expandability:
1. DDC system size shall be expandable to an ultimate capacity of at least two times total I/O points indicated.
 2. Additional DDC controllers, I/O and associated wiring shall be all that is needed to achieve ultimate capacity. Initial network infrastructure shall be designed and installed to support ultimate capacity.
 3. Operator interfaces installed initially shall not require hardware and software additions and revisions for ultimate capacity.
- H. Input Point Displayed Accuracy: Input point displayed values shall meet following end-to-end overall system accuracy, including errors associated with meter, sensor, transmitter, lead wire or cable, and analog to digital conversion.
1. Energy:

- a. Thermal: Within 3 percent of reading.
 - b. Electric Power: Within 1 percent of reading.
 - c. Requirements indicated on Drawings for meters not supplied by utility.
- 2. Temperature, Dew Point:
 - a. Air: Within 1 deg F.
 - b. Space: Within 1 deg F.
 - c. Outdoor: Within 3 deg F.
- 3. Temperature, Dry Bulb:
 - a. Air: Within 1 deg F.
 - b. Space: Within 1 deg F.
 - c. Outdoor: Within 2 deg F.
 - d. Temperature Difference: Within 0.25 deg F.
 - e. Other Temperatures Not Indicated: Within 1 deg F.
- 4. Temperature, Wet Bulb:
 - a. Air: Within 1 deg F.
 - b. Space: Within 1 deg F.
 - c. Outdoor: Within 2 deg F.
- I. Precision of I/O Reported Values: Values reported in database and displayed shall have following precision:
 - 1. Current:
 - a. Milliamperes: Nearest 1/100th of a milliampere.
 - b. Amperes: Nearest 1/10th of an ampere up to 100 A; nearest ampere for 100 A and more.
 - 2. Energy:
 - a. Electric Power:
 - 1) Rate (Watts): Nearest 1/10th of a watt through 1000 W.
 - 2) Rate (Kilowatts): Nearest 1/10th of a kilowatt through 1000 kW; nearest kilowatt above 1000 kW.
 - 3) Usage (Kilowatt-Hours): Nearest kilowatt through 10,000 kW; nearest 10 kW between 10,000 and 100,000 kW; nearest 100 kW for above 100,000 kW.
 - b. Thermal, Rate:
 - 1) Heating: For Btu/h, nearest Btu/h up to 1000 Btu/h; nearest 10 Btu/h between 1000 and 10,000 Btu/h; nearest 100 Btu/h for above 10,000 Btu/h. For Mbh, round to nearest Mbh up to 1000 Mbh; nearest 10 Mbh between 1000 and 10,000 Mbh; nearest 100 Mbh above 10,000 Mbh.

- 2) Cooling: For tons, nearest ton up to 1000 tons; nearest 10 tons between 1000 and 10,000 tons; nearest 100 tons above 10,000 tons.
- c. Thermal, Usage:
 - 1) Heating: For Btu, nearest Btu up to 1000 Btu; nearest 10 Btu between 1000 and 10,000 Btu; nearest 100 Btu for above 10,000 Btu. For Mbtu, round to nearest Mbtu up to 1000 Mbtu; nearest 10 Mbtu between 1000 and 10,000 Mbtu; nearest 100 Mbtu above 10,000 Mbtu.
 - 2) Cooling: For ton-hours, nearest ton-hours up to 1000 ton-hours; nearest 10 ton-hours between 1000 and 10,000 ton-hours; nearest 100 tons above 10,000 tons.
3. Temperature:
 - a. Air, Ducts and Equipment: Nearest 1/10th of a degree.
 - b. Outdoor: Nearest degree.
 - c. Space: Nearest 1/10th of a degree.
- J. Control Stability: Control variables indicated within the following limits:
 1. Flow:
 - a. Air, Ducts and Equipment, except Terminal Units: Within 5 percent of design flow rate.
 2. Temperature, Dry Bulb:
 - a. Air: Within 2 deg F.
 - b. Space: Within 2 deg F.
 3. Temperature, Wet Bulb:
 - a. Air: Within 1 deg F.
 - b. Space: Within 1 deg F.
- K. Environmental Conditions for Controllers, Gateways, and Routers:
 1. Products shall operate without performance degradation under ambient environmental temperature, pressure and humidity conditions encountered for installed location.
 - a. If product alone cannot comply with requirement, install product in a protective enclosure that is isolated and protected from conditions impacting performance. Enclosure shall be internally insulated, electrically heated, cooled and ventilated as required by product and application.

2. Products shall be protected with enclosures satisfying the following minimum requirements unless more stringent requirements are indicated. Products not available with integral enclosures complying with requirements indicated shall be housed in protective secondary enclosures. Installed location shall dictate the following NEMA 250 enclosure requirements:
 - a. Outdoors, Protected: Type 3.
 - b. Outdoors, Unprotected: Type 4X.
 - c. Indoors, Heated with Filtered Ventilation: Type 1.
 - d. Indoors, Heated with Non-Filtered Ventilation: Type 2 .
 - e. Indoors, Heated and Air Conditioned: Type 1.
 - f. Within Duct Systems and Air-Moving Equipment Not Exposed to Possible Condensation: Type 2.
 - g. Within Duct Systems and Air-Moving Equipment Exposed to Possible Condensation: Type 4X.
 - h. Hazardous Locations: Explosion-proof rating for condition.

L. Environmental Conditions for Instruments and Actuators:

1. Instruments and actuators shall operate without performance degradation under the ambient environmental temperature, pressure, humidity, and vibration conditions specified and encountered for installed location.
 - a. If instruments and actuators alone cannot comply with requirement, install instruments and actuators in protective enclosures that are isolated and protected from conditions impacting performance. Enclosure shall be internally insulated, electrically heated, cooled and ventilated as required by instrument and application.
2. Instruments, actuators and accessories shall be protected with enclosures satisfying the following minimum requirements unless more stringent requirements are indicated. Instruments and actuators not available with integral enclosures complying with requirements indicated shall be housed in protective secondary enclosures. Installed location shall dictate the following NEMA 250 enclosure requirements:
 - a. Outdoors, Protected: Type 3.
 - b. Outdoors, Unprotected: Type 4X.
 - c. Indoors, Heated with Filtered Ventilation: Type 2.
 - d. Indoors, Heated with Non-Filtered Ventilation: Type 2 .
 - e. Indoors, Heated and Air-conditioned: Type 1.
 - f. Localized Areas Exposed to Washdown: Type 4X.
 - g. Within Duct Systems and Air-Moving Equipment Not Exposed to Possible Condensation: Type 2.
 - h. Within Duct Systems and Air-Moving Equipment Exposed to Possible Condensation: Type 4.
 - i. Hazardous Locations: Explosion-proof rating for condition.
 - j. .

M. Electric Power Quality:

1. Power-Line Surges:
 - a. Protect DDC system products connected to ac power circuits from power-line surges to comply with requirements of IEEE C62.41.
 - b. Do not use fuses for surge protection.
 - c. Test protection in the normal mode and in the common mode, using the following two waveforms:
 - 1) 10-by-1000-mic.sec. waveform with a peak voltage of 1500 V and a peak current of 60 A.
 - 2) 8-by-20-mic.sec. waveform with a peak voltage of 1000 V and a peak current of 500 A.
2. Power Conditioning:
 - a. Protect DDC system products connected to ac power circuits from irregularities and noise rejection. Characteristics of power-line conditioner shall be as follows:
 - 1) At 85 percent load, output voltage shall not deviate by more than plus or minus 1 percent of nominal when input voltage fluctuates between minus 20 percent to plus 10 percent of nominal.
 - 2) During load changes from zero to full load, output voltage shall not deviate by more than plus or minus 3 percent of nominal.
 - 3) Accomplish full correction of load switching disturbances within five cycles, and 95 percent correction within two cycles of onset of disturbance.
 - 4) Total harmonic distortion shall not exceed 3-1/2 percent at full load.
3. Ground Fault: Protect products from ground fault by providing suitable grounding. Products shall not fail due to ground fault condition.

N. Backup Power Source:

1. HVAC systems and equipment served by a backup power source shall have associated DDC system products that control such systems and equipment also served from a backup power source.

O. UPS:

1. DDC system products powered by UPS units shall include the following:
 - a. Desktop workstations.
 - b. Printers.
 - c. Servers.
 - d. Gateways.
 - e. DDC controllers, except application-specific controllers.

P. Continuity of Operation after Electric Power Interruption:

1. Equipment and associated factory-installed controls, field-installed controls, electrical equipment, and power supply connected to building normal and backup power systems shall automatically return equipment and associated controls to operating state occurring immediately before loss of normal power, without need for manual intervention by operator when power is restored either through backup power source or through normal power if restored before backup power is brought online.

2.5 SYSTEM ARCHITECTURE

- A. System architecture shall consist of no more than two levels of LANs.
 1. Level one LAN shall connect network controllers and operator workstations.
 2. Level one LAN shall connect programmable application controllers to other programmable application controllers, and to network controllers.
 3. Level two LAN shall connect application-specific controllers to programmable application controllers and network controllers.
 4. LAN shall connect application-specific controllers to application-specific controllers.
- B. Minimum Data Transfer and Communication Speed:
 1. LAN Connecting Programmable Application Controllers: 1000 Insert value kbps.
 2. LAN Connecting Application-Specific Controllers: 115,000 Insert value bps.
- C. DDC system shall consist of dedicated and separated LANs that are not shared with other building systems and tenant data and communication networks.
- D. System architecture shall be modular and have inherent ability to expand to not less than two times system size indicated with no impact to performance indicated.
- E. System architecture shall perform modifications without having to remove and replace existing network equipment.
- F. Number of LANs and associated communication shall be transparent to operator. All I/O points residing on any LAN shall be capable of global sharing between all system LANs.
- G. System design shall eliminate dependence on any single device for system alarm reporting and control execution. Each controller shall operate independently by performing its' own control, alarm management and historical data collection.
- H. Special Network Architecture Requirements:
 1. Air-Handling Systems: For control applications of an air-handling system that consists of air-handling unit(s) and VAV terminal units, include a dedicated LAN of application-specific controllers serving VAV terminal units connected directly to controller that is controlling air-handling system air-handling unit(s). Basically, create a DDC system LAN that aligns with air-handling system being controlled.

2.6 DDC SYSTEM OPERATOR INTERFACES

- A. Operator Means of System Access: Operator shall be able to access entire DDC system through any of multiple means, including, but not limited to, the following:
 - 1. Desktop and portable workstation with hardwired connection through LAN port.
 - 2. Portable operator terminal with hardwired connection through LAN port.
 - 3. Portable operator workstation with wireless connection through LAN router.
 - 4. Mobile device and application with secured wireless connection through LAN router or cellular data service.
 - 5. Remote connection through web access.
- B. Access to system, regardless of operator means used, shall be transparent to operator.
- C. Portable Workstations:
 - 1. Connect to DDC system Level one LAN through a communications port directly on LAN or through a communications port on a DDC controller.
 - 2. Able to communicate with any device located on any DDC system LAN.
 - 3. Connect to DDC system Level two LAN through a communications port on an application-specific controller, or a room temperature sensor connected to an application-specific controller.
 - 4. Connect to system through a wireless router connected to Level one LAN.
 - 5. Connect to system through a cellular data service.
 - 6. Portable workstation shall be able to communicate with any device connected to any system LAN regardless of point of physical connection to system.
 - 7. Monitor, program, schedule, adjust set points, and report capabilities of I/O connected anywhere in system.
 - 8. Have dynamic graphic displays that are identical to desktop workstations.
- D. Critical Alarm Reporting:
 - 1. Operator-selected critical alarms shall be sent by DDC system to notify operator of critical alarms that require immediate attention.
 - 2. DDC system shall send alarm notification to multiple recipients that are assigned for each alarm.
 - 3. DDC system shall notify recipients by any or all means, including e-mail, text message and prerecorded phone message to mobile and landline phone numbers.
- E. Simultaneous Operator Use: Capable of accommodating up to five simultaneous operators that are accessing DDC system through any one of operator interfaces indicated.

2.7 NETWORK COMMUNICATION PROTOCOL

- A. Network communication protocol(s) used throughout entire DDC system shall be open to Owner and available to other companies for use in making future modifications to DDC system.

- B. ASHRAE 135 Protocol:

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1. ASHRAE 135 communication protocol shall be sole and native protocol used throughout entire DDC system.
2. DDC system shall not require use of gateways except to integrate HVAC equipment and other building systems and equipment, not required to use ASHRAE 135 communication protocol.
3. If used, gateways shall connect to DDC system using ASHRAE 135 communication protocol and Project object properties and read/write services indicated by interoperability schedule.
4. Operator workstations, controllers and other network devices shall be tested and listed by BACnet Testing Laboratories.

C. Industry Standard Protocols:

1. DDC system shall use any one or a combination of the following industry standard protocols for network communication while complying with other DDC system requirements indicated:
 - a. ASHRAE 135.
2. Operator workstations and network controllers shall communicate through ASHRAE 135 protocol.
3. Portions of DDC system networks using ASHRAE 135 communication protocol shall be an open implementation of network devices complying with ASHRAE 135. Network devices shall be tested and listed by BACnet Testing Laboratories.
4. Gateways shall be used to connect networks and network devices using different protocols.

2.8 SERVERS

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

1. Dell Inc.

B. Mounting: Rack.

C. Performance Requirements:

1. Performance requirements may dictate equipment exceeding minimum requirements indicated.
2. Energy Star compliant.
3. Minimum Processor Speed: 3.10GHz.RAM:
 - a. Capacity: 16 GB.
 - b. Expandable Capacity: 16.
4. Hard-Drive Storage: One drives each with 2.0 TB storage and nominal rotational speed of 7200 rpm.
5. Network Interface: Dual port Gigabit Ethernet.

6. DVD +RW Drive.
7. Next-day on-site warranty for two -year period following Substantial Completion.

D. Servers shall include the following:

1. Full-feature backup server (server and backup minimum requirement).
2. Software licenses.
3. Cable installation between server(s) and network.

E. Web Server:

1. If required to be separate, include Web server hardware and software to match, except backup server is not required.
2. Firewalls between server Web and networks.
3. Password protection for access to server from Web server.
4. Cable installation between the server(s) and building Ethernet network.

F. Power each server through a dedicated UPS unit.

2.9 SYSTEM SOFTWARE

A. Operator Interface Software:

1. Minimize operator training through use of English language prorating and English language point identification.
2. Minimize use of a typewriter-style keyboard through use of a pointing device similar to a mouse.
3. Operator sign-off shall be a manual operation or, if no keyboard or mouse activity takes place, an automatic sign-off.
4. Automatic sign-off period shall be programmable from one to 60 minutes in one-minute increments on a per operator basis.
5. Operator sign-on and sign-off activity shall be recorded and sent to printer.

6. Reporting:

- a. Generated automatically and manually.
- b. Sent to displays, printers and disk files.
- c. Types of Reporting:

- 1) General listing of points.
- 2) List points currently in alarm.
- 3) List of off-line points.
- 4) List points currently in override status.
- 5) List of disabled points.
- 6) List points currently locked out.
- 7) List of items defined in a "Follow-Up" file.
- 8) List weekly schedules.
- 9) List holiday programming.
- 10) List of limits and deadbands.

7. Summaries: For specific points, for a logical point group, for an operator selected group(s), or for entire system without restriction due to hardware configuration.

B. Graphic Interface Software:

1. Include a full interactive graphical selection means of accessing and displaying system data to operator. Include at least five levels with the penetration path operator assignable (for example, site, building, floor, air-handling unit, and supply temperature loop). Native language descriptors assigned to menu items are to be operator defined and modifiable under password control.
2. Include a hierarchical-linked dynamic graphic operator interface for accessing and displaying system data and commanding and modifying equipment operation. Interface shall use a pointing device with pull-down or penetrating menus, color and animation to facilitate operator understanding of system.
3. Include at least 10 levels of graphic penetration with the hierarchy operator assignable.
4. Descriptors for graphics, points, alarms and such shall be modified through operator's workstation under password control.
5. Graphic displays shall be online user definable and modifiable using the hardware and software provided.
6. Data to be displayed within a graphic shall be assignable regardless of physical hardware address, communication or point type.
7. Graphics are to be online programmable and under password control.
8. Points may be assignable to multiple graphics where necessary to facilitate operator understanding of system operation.
9. Graphics shall also contain software points.
10. Penetration within a graphic hierarchy shall display each graphic name as graphics are selected to facilitate operator understanding.
11. Back-trace feature shall permit operator to move upward in the hierarchy using a pointing device. Back trace shall show all previous penetration levels. Include operator with option of showing each graphic full screen size with back trace as horizontal header or by showing a "stack" of graphics, each with a back trace.
12. Display operator accessed data on the monitor.
13. Operator shall select further penetration using pointing device to click on a site, building, floor, area, equipment, and so on. Defined and linked graphic below that selection shall then be displayed.
14. Include operator with means to directly access graphics without going through penetration path.
15. Dynamic data shall be assignable to graphics.
16. Display points (physical and software) with dynamic data provided by DDC system with appropriate text descriptors, status or value, and engineering unit.
17. Use color, rotation, or other highly visible means, to denote status and alarm states. Color shall be variable for each class of points, as chosen by operator.
18. Points shall be dynamic with operator adjustable update rates on a per point basis from one second to over a minute.
19. For operators with appropriate privilege, points shall be commanded directly from display using pointing device.

- a. For an analog command point such as set point, current conditions and limits shall be displayed and operator can position new set point using pointing device.
 - b. For a digital command point such as valve position, valve shall show its current state such as open or closed and operator could select alternative position using pointing device.
 - c. Keyboard equivalent shall be available for those operators with that preference.
- 20. Operator shall be able to split or resize viewing screen into quadrants to show one graphic on one quadrant of screen and other graphics or spreadsheet, bar chart, word processing, curve plot and other information on other quadrants on screen. This feature shall allow real-time monitoring of one part of system while displaying other parts of system or data to better facilitate overall system operation.
- 21. Help Features:
 - a. On-line context-sensitive help utility to facilitate operator training and understanding.
 - b. Bridge to further explanation of selected keywords. Document shall contain text and graphics to clarify system operation.
 - 1) If help feature does not have ability to bridge on keywords for more information, a complete set of user manuals shall be provided in an indexed word-processing program, which shall run concurrently with operating system software.
 - c. Available for Every Menu Item:
 - 1) Index items for each system menu item.
- 22. Graphic generation software shall allow operator to add, modify, or delete system graphic displays.
 - a. Include libraries of symbols depicting HVAC symbols such as fans, coils, filters, dampers, valves pumps, and electrical symbols similar to those indicated.
 - b. Graphic development package shall use a pointing device in conjunction with a drawing program to allow operator to perform the following:
 - 1) Define background screens.
 - 2) Define connecting lines and curves.
 - 3) Locate, orient and size descriptive text.
 - 4) Define and display colors for all elements.
 - 5) Establish correlation between symbols or text and associated system points or other displays.

C. Project-Specific Graphics: Graphics documentation including, but not limited to, the following:

1. Site plan showing each building, and additional site elements, which are being controlled or monitored by DDC system.
2. Plan for each building floor, including interstitial floors, and each roof level of each building, showing the following:
 - a. Room layouts with room identification and name.
 - b. Locations and identification of all monitored and controlled HVAC equipment and other equipment being monitored and controlled by DDC system.
 - c. Location and identification of each hardware point being controlled or monitored by DDC system.
3. Control schematic for each of following, including a graphic system schematic representation, similar to that indicated on Drawings, with point identification, set point and dynamic value indication, sequence of operation.
4. Graphic display for each piece of equipment connected to DDC system through a data communications link. Include dynamic indication of all points associated with equipment.
5. DDC system network riser diagram that shows schematic layout for entire system including all networks and all controllers, gateways and other network devices.

D. Alarm Handling Software:

1. Include alarm handling software to report all alarm conditions monitored and transmitted through DDC controllers, gateways and other network devices.
2. Include first in, first out handling of alarms according to alarm priority ranking, with most critical alarms first, and with buffer storage in case of simultaneous and multiple alarms.
3. Alarm handling shall be active at all times to ensure that alarms are processed even if an operator is not currently signed on to DDC system.
4. Alarms display shall include the following:
 - a. Indication of alarm condition such as "Abnormal Off," "Hi Alarm," and "Low Alarm."
 - b. "Analog Value" or "Status" group and point identification with native language point descriptor such as "Space Temperature, Building 110, 2nd Floor, Room 212."
 - c. Discrete per point alarm action message, such as "Call Maintenance Dept. Ext-5561."
 - d. Include extended message capability to allow assignment and printing of extended action messages. Capability shall be operator programmable and assignable on a per point basis.
5. Alarms shall be directed to appropriate operator workstations, printers, and individual operators by privilege level and segregation assignments.
6. Send e-mail alarm messages to designated operators.
7. Send e-mail, page, text and voice messages to designated operators for critical alarms.
8. Alarms shall be categorized and processed by class.

- a. Class 1:
 - 1) Associated with fire, security and other extremely critical equipment monitoring functions; have alarm, trouble, return to normal, and acknowledge conditions printed and displayed.
 - 2) Unacknowledged alarms to be placed in unacknowledged alarm buffer.
 - 3) All conditions shall cause an audible sound and shall require individual acknowledgment to silence audible sound.
- b. Class 2:
 - 1) Critical, but not life-safety related, and processed same as Class 1 alarms, except do not require individual acknowledgment.
 - 2) Acknowledgement may be through a multiple alarm acknowledgment.
- c. Class 3:
 - 1) General alarms; printed, displayed and placed in unacknowledged alarm buffer queues.
 - 2) Each new alarm received shall cause an audible sound. Audible sound shall be silenced by "acknowledging" alarm or by pressing a "silence" key.
 - 3) Acknowledgement of queued alarms shall be either on an individual basis or through a multiple alarm acknowledgement.
 - 4) Alarms returning to normal condition shall be printed and not cause an audible sound or require acknowledgment.
- d. Class 4:
 - 1) Routine maintenance or other types of warning alarms.
 - 2) Alarms to be printed only, with no display, no audible sound and no acknowledgment required.
9. Include an unacknowledged alarm indicator on display to alert operator that there are unacknowledged alarms in system. Operator shall be able to acknowledge alarms on an individual basis or through a multiple alarm acknowledge key, depending on alarm class.
10. To ensure that no alarm records are lost, it shall be possible to assign a backup printer to accept alarms in case of failure of primary printer.

E. Reports and Logs:

1. Include reporting software package that allows operator to select, modify, or create reports using DDC system I/O point data available.
2. Each report shall be definable as to data content, format, interval and date.
3. Report data shall be sampled and stored on DDC controller, within storage limits of DDC controller, and then uploaded to archive on server for historical reporting.

4. Operator shall be able to obtain real-time logs of all I/O points by type or status, such as alarm, point lockout, or normal.
 5. Reports and logs shall be stored on server hard drives in a format that is readily accessible by other standard software applications, including spreadsheets and word processing.
 6. Reports and logs shall be readily printed and set to be printed either on operator command or at a specific time each day.
- F. Standard Reports: Standard DDC system reports shall be provided and operator shall be able to customize reports later.
1. All I/O: With current status and values.
 2. Alarm: All current alarms, except those in alarm lockout.
 3. Disabled I/O: All I/O points that are disabled.
 4. Alarm Lockout I/O: All I/O points in alarm lockout, whether manual or automatic.
 5. Alarm Lockout I/O in Alarm: All I/O in alarm lockout that are currently in alarm.
 6. Logs:
 - a. Alarm history.
 - b. System messages.
 - c. System events.
 - d. Trends.
- G. Custom Reports: Operator shall be able to easily define any system data into a daily, weekly, monthly, or annual report. Reports shall be time and date stamped and shall contain a report title.
- H. Tenant Override Reports: Prepare Project-specific reports.
1. Weekly report showing daily total time in hours that each tenant has requested after-hours HVAC.
 2. Monthly report showing daily total time in hours that each tenant has requested after-hours HVAC.
 3. Annual summary report that shows after-hours HVAC usage on a monthly basis.
- I. Utility Reports: Prepare Project-specific reports.
1. Electric Report:
 - a. Include weekly report showing daily electrical consumption and peak electrical demand with time and date stamp for each meter.
 - b. Include monthly report showing the daily electrical consumption and peak electrical demand with time and date stamp for each meter.
 - c. Include annual report showing the monthly electrical consumption and peak electrical demand with time and date stamp for each meter.
 - d. For each weekly, monthly and annual report, include sum total of submeters combined by load type, such as lighting, receptacles and HVAC equipment showing daily electrical consumption and peak electrical demand.

- e. For each weekly, monthly and annual report, include sum total of all submeters in building showing electrical consumption and peak electrical demand.
- J. Energy Reports: Prepare Project-specific daily, weekly, monthly and annual , annual and since-installed energy reports.
 - 1. Prepare report for each purchased energy utility, indicating the following:
 - a. Time period being reported with beginning and end date, and time indicated.
 - b. Consumption in units of measure commonly used to report specific utility consumption over time.
 - c. Gross area served by utility.
 - d. Consumption per unit area served using utility-specific unit of measure.
 - e. Cost per utility unit.
 - f. Utility cost per unit area.
 - g. Convert all utilities to a common energy consumption unit of measure and report for each utility.
 - h. Consumption per unit area using common unit of measure.
- K. HVAC System Efficiency Reports: Prepare Project-specific monthly and annual HVAC system efficiency reports.
 - 1. Insert requirements for each HVAC system requiring a report.
- L. Standard Trends:
 - 1. Trend all I/O point present values, set points, and other parameters indicated for trending.
 - 2. Trends shall be associated into groups, and a trend report shall be set up for each group.
 - 3. Trends shall be stored within DDC controller and uploaded to hard drives automatically on reaching 75 of DDC controller buffer limit, or by operator request, or by archiving time schedule.
 - 4. Preset trend intervals for each I/O point after review with Owner.
 - 5. Trend intervals shall be operator selectable from 10 seconds up to 60 minutes. Minimum number of consecutive trend values stored at one time shall be 100 per variable.
 - 6. When drive storage memory is full, most recent data shall overwrite oldest data.
 - 7. Archived and real-time trend data shall be available for viewing numerically and graphically by operators.
- M. Custom Trends: Operator shall be able to define a custom trend log for any I/O point in DDC system.
 - 1. Each trend shall include interval, start time, and stop time.
 - 2. Data shall be sampled and stored on DDC controller, within storage limits of DDC controller, and then uploaded to archive on server hard drives.
 - 3. Data shall be retrievable for use in spreadsheets and standard database programs.

N. Programming Software:

1. Include programming software to execute sequences of operation indicated.
2. Include programming routines in simple and easy to follow logic with detailed text comments describing what the logic does and how it corresponds to sequence of operation.
3. Programming software shall be as follows any of the following one of the following:
 - a. Graphic Based: Programming shall use a library of function blocks made from preprogrammed code designed for DDC control systems.
 - 1) Function blocks shall be assembled with interconnection lines that represent to control sequence in a flowchart.
 - 2) Programming tools shall be viewable in real time to show present values and logical results of each function block.
 - b. Menu Based: Programming shall be done by entering parameters, definitions, conditions, requirements and constraints.
 - c. Line by Line and Text Based: Programming shall declare variable types such as local, global, real, integer, and so on, at the beginning of the program. Use descriptive comments frequently to describe programming code.
4. Include means for detecting programming errors and testing software control strategies with a simulation tool before implementing in actual control. Simulation tool may be inherent with programming software or as a separate product.

2.10 ASHRAE 135 GATEWAYS

- A. Include BACnet communication ports, whenever available as an equipment OEM standard option, for integration via a single communication cable. BACnet-controlled plant equipment includes, but is not limited to, boilers, chillers, Insert equipment, and variable-speed drives.
- B. Include gateways to connect BACnet to legacy systems, existing non-BACnet devices, and existing non-BACnet DDC-controlled equipment, only when specifically requested and approved by Owner.
- C. Include with each gateway an interoperability schedule showing each point or event on legacy side that BACnet "client" will read, and each parameter that BACnet network will write to. Describe this interoperability of BACnet services, or BIBBs, defined in ASHRAE 135, Annex K.
- D. Gateway Minimum Requirements:
 1. Read and view all readable object properties on non-BACnet network to BACnet network and vice versa where applicable.

2. Write to all writeable object properties on non-BACnet network from BACnet network and vice versa where applicable.
3. Include single-pass (only one protocol to BACnet without intermediary protocols) translation from non-BACnet protocol to BACnet and vice versa.
4. Comply with requirements of Data Sharing Read Property, Data Sharing Write Property, Device Management Dynamic Device Binding-B, and Device Management Communication Control BIBBs according to ASHRAE 135.
5. Hardware, software, software licenses, and configuration tools for operator-to-gateway communications.
6. Backup programming and parameters on CD media and the ability to modify, download, backup, and restore gateway configuration.

2.11 WIRELESS ROUTERS FOR OPERATOR INTERFACE

A. Dual-Band Wireless Routers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cisco Linksys.
 - b. D-Link Corporation/D-Link Systems, Inc.
 - c. NETGEAR Inc.
2. Speed: Up to Insert number Mbps on 2.4-GHz band and up to 450 Mbps on 5-GHz band.
3. Compatibility: IEEE 802.11n/g/b/a wireless devices.
4. Ethernet Ports: Four, gigabit (1000 Mbps).
5. USB Port: One, USB 2.0 or 3.0.

2.12 DDC CONTROLLERS

- A. DDC system shall consist of a combination of network controllers, programmable application controllers and application-specific controllers to satisfy performance requirements indicated.
- B. DDC controllers shall perform monitoring, control, energy optimization and other requirements indicated.
- C. DDC controllers shall use a multitasking, multiuser, real-time digital control microprocessor with a distributed network database and intelligence.
- D. Each DDC controller shall be capable of full and complete operation as a completely independent unit and as a part of a DDC system wide distributed network.
- E. Power and Noise Immunity:
 1. Controller shall operate at 90 to 110 percent of nominal voltage rating and shall perform an orderly shutdown below 80 percent of nominal voltage.
 2. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios with up to 5 W of power located within 36 inches of enclosure.

F. DDC Controller Spare Processing Capacity:

1. Include spare processing memory for each controller. RAM, PROM, or EEPROM will implement requirements indicated with the following spare memory:
 - a. Network Controllers: 50 percent.
 - b. Programmable Application Controllers: Not less than 60 percent.
 - c. Application-Specific Controllers: Not less than 70 percent.

G. Maintenance and Support: Include the following features to facilitate maintenance and support:

1. Mount microprocessor components on circuit cards for ease of removal and replacement.
2. Means to quickly and easily disconnect controller from network.
3. Means to quickly and easily access connect to field test equipment.
4. Visual indication that controller electric power is on, of communication fault or trouble, and that controller is receiving and sending signals to network.

2.13 NETWORK CONTROLLERS

A. General Network Controller Requirements:

1. Include adequate number of controllers to achieve performance indicated.
2. System shall consist of one or more independent, standalone, microprocessor-based network controllers to manage global strategies indicated.
3. Controller shall have enough memory to support its operating system, database, and programming requirements.
4. Data shall be shared between networked controllers and other network devices.
5. Operating system of controller shall manage input and output communication signals to allow distributed controllers to share real and virtual object information and allow for central monitoring and alarms.
6. Controllers that perform scheduling shall have a real-time clock.
7. Controller shall continually check status of its processor and memory circuits. If an abnormal operation is detected, controller shall assume a predetermined failure mode and generate an alarm notification.
8. Controllers shall be fully programmable.

B. Communication:

1. Network controllers shall communicate with other devices on DDC system Level one network.
2. Network controller also shall perform routing if connected to a network of programmable application and application-specific controllers.

C. Operator Interface:

1. Controller shall be equipped with a service communications port for connection to a portable operator's workstation or mobile device.

D. Serviceability:

1. Controller shall be equipped with diagnostic LEDs or other form of local visual indication of power, communication, and processor.
2. Wiring and cable connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
3. Controller shall maintain BIOS and programming information in event of a power loss for at least 72 hours.

2.14 PROGRAMMABLE APPLICATION CONTROLLERS

A. General Programmable Application Controller Requirements:

1. Include adequate number of controllers to achieve performance indicated.
2. Controller shall have enough memory to support its operating system, database, and programming requirements.
3. Data shall be shared between networked controllers and other network devices.
4. Operating system of controller shall manage input and output communication signals to allow distributed controllers to share real and virtual object information and allow for central monitoring and alarms.
5. Controllers that perform scheduling shall have a real-time clock.
6. Controller shall continually check status of its processor and memory circuits. If an abnormal operation is detected, controller shall assume a predetermined failure mode and generate an alarm notification.
7. Controllers shall be fully programmable.

B. Communication:

1. Programmable application controllers shall communicate with other devices on network.

C. Operator Interface:

1. Controller shall be equipped with a service communications port for connection to a portable operator's workstation or mobile device.

D. Serviceability:

1. Controller shall be equipped with diagnostic LEDs or other form of local visual indication of power, communication, and processor.
2. Wiring and cable connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
3. Controller shall maintain BIOS and programming information in event of a power loss for at least 72 hours.

2.15 APPLICATION-SPECIFIC CONTROLLERS

- A. Description: Microprocessor-based controllers, which through hardware or firmware design are dedicated to control a specific piece of equipment. Controllers are not fully user-programmable but are configurable and customizable for operation of equipment they are designed to control.
 - 1. Capable of standalone operation and shall continue to include control functions without being connected to network.
 - 2. Data shall be shared between networked controllers and other network devices.
- B. Communication: Application-specific controllers shall communicate with other application-specific controller and devices on network, and to programmable application and network controllers.
- C. Operator Interface: Controller shall be equipped with a service communications port for connection to a portable operator's workstation. Connection shall extend to port on space temperature sensor that is connected to controller.
- D. Serviceability:
 - 1. Controller shall be equipped with diagnostic LEDs or other form of local visual indication of power, communication, and processor.
 - 2. Wiring and cable connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
 - 3. Controller shall use nonvolatile memory and maintain all BIOS and programming information in event of power loss.

2.16 CONTROLLER SOFTWARE

- A. General Controller Software Requirements:
 - 1. Software applications shall reside and operate in controllers. Editing of applications shall occur at operator workstations.
 - 2. I/O points shall be identified by up to 30 -character point name and up to 16 -character point descriptor. Same names shall be used at operator workstations.
 - 3. Control functions shall be executed within controllers using DDC algorithms.
 - 4. Controllers shall be configured to use stored default values to ensure fail-safe operation. Default values shall be used when there is a failure of a connected input instrument or loss of communication of a global point value.
- B. Scheduling: Include capability to schedule each point or group of points in system. Each schedule shall consist of the following:
 - 1. Weekly Schedule:
 - a. Include separate schedules for each day of week.
 - b. Each schedule should include the capability for start, stop, optimal start, optimal stop, and night economizer.
 - c. Each schedule may consist of up to 10 events.

- d. When a group of objects are scheduled together, include capability to adjust start and stop times for each member.
- 2. Exception Schedules:
 - a. Include ability for operator to designate any day of the year as an exception schedule.
 - b. Exception schedules may be defined up to a year in advance. Once an exception schedule is executed, it will be discarded and replaced by regular schedule for that day of week.
- 3. Holiday Schedules:
 - a. Include capability for operator to define up to 99 special or holiday schedules.
 - b. Schedules may be placed on scheduling calendar and will be repeated each year.
 - c. Operator shall be able to define length of each holiday period.
- C. System Coordination:
 - 1. Include standard application for proper coordination of equipment.
 - 2. Application shall include operator with a method of grouping together equipment based on function and location.
 - 3. Group may then be used for scheduling and other applications.
- D. Binary Alarms:
 - 1. Each binary point shall be set to alarm based on operator-specified state.
 - 2. Include capability to automatically and manually disable alarming.
- E. Analog Alarms:
 - 1. Each analog object shall have both high and low alarm limits.
 - 2. Alarming shall be able to be automatically and manually disabled.
- F. Alarm Reporting:
 - 1. Operator shall be able to determine action to be taken in event of an alarm.
 - 2. Alarms shall be routed to appropriate operator workstations based on time and other conditions.
 - 3. Alarm shall be able to start programs, print, be logged in event log, generate custom messages, and display graphics.
- G. Remote Communication:
 - 1. System shall have ability to dial out in the event of an alarm.
- H. Electric Power Demand Limiting:

1. Demand-limiting program shall monitor building or other operator-defined electric power consumption from signals connected to electric power meter or from a watt transducer or current transformer.
 2. Demand-limiting program shall predict probable power demand such that action can be taken to prevent exceeding demand limit. When demand prediction exceeds demand limit, action will be taken to reduce loads in a predetermined manner. When demand prediction indicates demand limit will not be exceeded, action will be taken to restore loads in a predetermined manner.
 3. Demand reduction shall be accomplished by the following means:
 - a. Reset air-handling unit supply temperature set points.
 - b. Reset space temperature set points.
 - c. De-energize equipment based on priority.
 4. Demand-limiting parameters, frequency of calculations, time intervals, and other relevant variables shall be based on the means by which electric power service provider computes demand charges.
 5. Include demand-limiting prediction and control for any individual meter monitored by system or for total of any combination of meters.
 6. Include means operator to make the following changes online:
 - a. Addition and deletion of loads controlled.
 - b. Changes in demand intervals.
 - c. Changes in demand limit for meter(s).
 - d. Maximum shutoff time for equipment.
 - e. Minimum shutoff time for equipment.
 - f. Select rotational or sequential shedding and restoring.
 - g. Shed and restore priority.
 7. Include the following information and reports, to be available on an hourly, daily, weekly, monthly and annual basis:
 - a. Total electric consumption.
 - b. Peak demand.
 - c. Date and time of peak demand.
 - d. Daily peak demand.
- I. Maintenance Management: System shall monitor equipment status and generate maintenance messages based on operator-designated run-time, starts, and calendar date limits.
- J. Sequencing: Include application software based on sequences of operation indicated to properly sequence chillers, boilers, and other applicable HVAC equipment.
- K. Control Loops:
1. Support any of the following control loops, as applicable to control required:
 - a. Two-position (on/off, open/close, slow/fast) control.
 - b. Proportional control.

- c. Proportional plus integral (PI) control.
 - d. Proportional plus integral plus derivative (PID) control.
 - 1) Include PID algorithms with direct or reverse action and anti-windup.
 - 2) Algorithm shall calculate a time-varying analog value used to position an output or stage a series of outputs.
 - 3) Controlled variable, set point, and PID gains shall be operator-selectable.
 - e. Adaptive (automatic tuning).
- L. Staggered Start: Application shall prevent all controlled equipment from simultaneously restarting after a power outage. Order which equipment (or groups of equipment) is started, along with the time delay between starts, shall be operator-selectable.
- M. Energy Calculations:
- 1. Include software to allow instantaneous power or flow rates to be accumulated and converted to energy usage data.
 - 2. Include an algorithm that calculates a sliding-window average (rolling average). Algorithm shall be flexible to allow window intervals to be operator specified (such as 15, 30, or 60 minutes).
 - 3. Include an algorithm that calculates a fixed-window average. A digital input signal shall define start of window period (such as signal from utility meter) to synchronize fixed-window average with that used by utility.
- N. Anti-Short Cycling:
- 1. BO points shall be protected from short cycling.
 - 2. Feature shall allow minimum on-time and off-time to be selected.
- O. On and Off Control with Differential:
- 1. Include an algorithm that allows a BO to be cycled based on a controlled variable and set point.
 - 2. Algorithm shall be direct- or reverse-acting and incorporate an adjustable differential.
- P. Run-Time Totalization:
- 1. Include software to totalize run-times for all BI and BO points.
 - 2. A high run-time alarm shall be assigned, if required, by operator.

2.17 ENCLOSURES

A. General Enclosure Requirements:

1. House each controller and associated control accessories in a single enclosure. Enclosure shall serve as central tie-in point for control devices such as switches, transmitters, transducers, power supplies and transformers.
2. Do not house more than one controller in a single enclosure.
3. Include enclosure door with key locking mechanism. Key locks alike for all enclosures and include one pair of keys per enclosure.
4. Equip doors of enclosures housing controllers and components with analog or digital displays with windows to allow visual observation of displays without opening enclosure door.
5. Individual wall-mounted single-door enclosures shall not exceed 36 inches wide and 48 inches high.
6. Individual wall-mounted double-door enclosures shall not exceed 60 inches wide and 36 inches high.
7. Freestanding enclosures shall not exceed 48 inches wide and 72 inches high.
8. Include wall-mounted enclosures with brackets suitable for mounting enclosures to wall or freestanding support stand as indicated.
9. Supply each enclosure with a complete set of as-built schematics, tubing, and wiring diagrams and product literature located in a pocket on inside of door. For enclosures with windows, include pocket on bottom of enclosure.

B. Environmental Requirements:

1. Evaluate temperature and humidity requirements of each product to be installed within each enclosure.
2. Calculate enclosure internal operating temperature considering heat dissipation of all products installed within enclosure and ambient effects (solar, conduction and wind) on enclosure.
3. Where required by application, include temperature-controlled electrical heat to maintain inside of enclosure above minimum operating temperature of product with most stringent requirement.
4. Where required by application, include temperature-controlled ventilation fans with filtered louver(s) to maintain inside of enclosure below maximum operating temperature of product with most stringent requirement.
5. Include temperature-controlled cooling within the enclosure for applications where ventilation fans cannot maintain inside temperature of enclosure below maximum operating temperature of product with most stringent requirement.
6. Where required by application, include humidity-controlled electric dehumidifier or cooling to maintain inside of enclosure below maximum relative humidity of product with most stringent requirement and to prevent surface condensation within enclosure.

2.18 RELAYS

A. General-Purpose Relays:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Siemens Building Technologies, Inc.

2. Relays shall be heavy duty and rated for at least 10 A at 250-V ac and 60 Hz.
3. Relays shall be either double pole double throw (DPDT) or three-pole double throw, depending on the control application.
4. Use a plug-in-style relay with an eight-pin octal plug for DPDT relays and an 11-pin octal plug for three-pole double-throw relays.
5. Construct the contacts of either silver cadmium oxide or gold.
6. Enclose the relay in a clear transparent polycarbonate dust-tight cover.
7. Relays shall have LED indication and a manual reset and push-to-test button.
8. Equip relays with coil transient suppression to limit transients to non-damaging levels.
9. Plug each relay into an industry-standard, 35-mm DIN rail socket. Plug all relays located in control panels into sockets that are mounted on a DIN rail.
10. Relay socket shall have screw terminals. Mold into the socket the coincident screw terminal numbers and associated octal pin numbers.

B. Current Sensing Relay:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Square D; by Schneider Electric.
2. Monitors ac current.
3. Independent adjustable controls for pickup and dropout current.
4. Energized when supply voltage is present and current is above pickup setting.
5. De-energizes when monitored current is below dropout current.
6. Dropout current is adjustable from 50 to 95 percent of pickup current.
7. Include a current transformer, if required for application.
8. House current sensing relay and current transformer in its own enclosure. Use NEMA 250, Type 12 enclosure for indoors and NEMA 250, Type 4 for outdoors.

C. Combination On-Off Status Sensor and On-Off Relay:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Functional Devices Inc.
2. Description:
 - a. On-off control and status indication in a single device.
 - b. LED status indication of activated relay and current trigger.
 - c. Closed-Open-Auto override switch located on the load side of the relay.
3. Status Indication:
 - a. Current Sensor: Integral sensing for single-phase loads up to 20 A and external solid or split sensing ring for three-phase loads up to 150 A.
 - b. Current Sensor Range: As required by application.
 - c. Current Set Point: Fixed or adjustable as required by application.

4. Relay: Single-pole double-throw, continuous-duty coil; rated for 10-million mechanical cycles.
5. Enclosure: NEMA 250, Type 1 enclosure.

2.19 ELECTRICAL POWER DEVICES

A. Transformers:

1. Transformer shall be sized for the total connected load, plus an additional 25 percent of connected load.
2. Transformer shall be at least 100 VA.
3. Transformer shall have both primary and secondary fuses.

B. Transient Voltage Suppression and High-Frequency Noise Filter Unit:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Current Technology Inc.
2. The maximum continuous operating voltage shall be at least 125 percent.
3. The operating frequency range shall be 47 to 63 Hz.
4. Protection modes according to NEMA LS-1.
5. Unit shall have LED status indicator that extinguishes to indicate a failure.
6. Unit shall be listed by an NRTL as a transient voltage surge suppressor per UL 1449, and as an electromagnetic interference filter per UL 1283.
7. Unit shall not generate any appreciable magnetic field.
8. Unit shall not generate an audible noise.

2.20 CONTROL WIRE AND CABLE

A. Single Twisted Shielded Instrumentation Cable above 24 V:

1. Wire size shall be a minimum No. 18 AWG.
2. Conductors shall be a twisted, 7/24 soft annealed copper strand with a 2- to 2.5-inch lay.
3. Conductor insulation shall have a Type THHN/THWN or Type TFN rating.
4. Shielding shall be 100 percent type, 0.35/0.5-mil aluminum/Mylar tape, helically applied with 25 percent overlap, and aluminum side in with tinned copper drain wire.
5. Outer jacket insulation shall have a 600-V, 90-deg C rating and shall be Type TC cable.
6. For twisted pair, conductor colors shall be black and white. For twisted triad, conductor colors shall be black, red and white.
7. Furnish wire on spools.

B. Single Twisted Shielded Instrumentation Cable 24 V and Less:

1. Wire size shall be a minimum No. 18 AWG.

2. Conductors shall be a twisted, 7/24 soft annealed copper stranding with a 2- to 2.5-inch lay.
 3. Conductor insulation shall have a nominal 15-mil thickness, constructed from flame-retardant PVC.
 4. Shielding shall be 100 percent type, 1.35-mil aluminum/polymer tape, helically applied with 25 percent overlap, and aluminum side in with tinned copper drain wire.
 5. Outer jacket insulation shall have a 300-V, 105-deg C rating and shall be Type PLTC cable.
 6. For twisted pair, conductor colors shall be black and white. For twisted triad, conductor colors shall be black, red and white.
 7. Furnish wire on spools.
- C. LAN and Communication Cable: Comply with DDC system manufacturer requirements for network being installed.
1. Cable shall be balanced twisted pair.
 2. Comply with the following requirements and for balanced twisted pair cable described in Section 260523 "Control-Voltage Electrical Power Cables." Section 271513 "Communications Copper Horizontal Cabling."
 - a. Cable shall be plenum rated.
 - b. Cable shall have a unique color that is different from other cables used on Project.

2.21 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate the following according to industry standards for each product, and to verify DDC system reliability specified in performance requirements:
1. DDC controllers.
 2. Gateways.
 3. Routers.
 4. Server..
- B. Product(s) and material(s) will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify compatibility with and suitability of substrates.
 - B. Examine roughing-in for products to verify actual locations of connections before installation.
 1. Examine roughing-in for instruments installed in piping to verify actual locations of connections before installation.
 2. Examine roughing-in for instruments installed in duct systems to verify actual locations of connections before installation.
 - C. Examine walls, floors, roofs, and ceilings for suitable conditions where product will be installed.
 - D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
 - E. Proceed with installation only after unsatisfactory conditions have been corrected.
- 3.2 DDC SYSTEM INTERFACE WITH OTHER SYSTEMS AND EQUIPMENT
- A. Communication Interface to Equipment with Integral Controls:
 1. DDC system shall have communication interface with equipment having integral controls and having a communication interface for remote monitoring or control.
 2. Equipment to Be Connected:
 - a. Roof-top units.
 - b. Exhaust Fans..
- 3.3 DDC SYSTEM INTERFACE WITH EXISTING SYSTEMS
- A. Interface with Existing Systems:
 1. DDC systems shall interface existing systems to achieve integration.
 2. Monitoring and Control of DDC System by Existing Control System:
 - a. DDC system performance requirements shall be satisfied when monitoring and controlling DDC system by existing control system.
 - b. Operator of existing system shall be able to upload, download, monitor, trend, control and program every input and output point in DDC system from existing control system using existing control system software and operator workstations.
 - c. Remote monitoring and control from existing control system shall not require operators of existing control system to learn new software.
 - d. Interface of DDC system into existing control system shall be transparent to operators of existing control system and allow operators to program, monitor, and control DDC system from any operator workstation connected to existing control system.
 - e. Insert requirements.

3. Integration of Existing Control System into DDC System:
 - a. Existing control system performance requirements shall be satisfied when monitoring and controlling existing control system through DDC system.
 - b. Operator shall be able to upload, download, monitor, alarm, report, trend, control and program every input and output point in existing system from DDC system using operator workstations and software provided. The combined systems shall share one database.
 - c. Interface of existing control system I/O points into DDC system shall be transparent to operators. All operational capabilities shall be identical regardless of whether I/O already exists or I/O is being installed.
 - d. Insert requirements.

B. Integration with Existing Enterprise System:

1. DDC system shall interface with an existing enterprise system to adhere to Owner standards already in-place and to achieve integration.
2. Owner's control system integrator will provide the following services:
 - a. Enterprise system expansion and development of graphics, logs, reports, trends and other operational capabilities of enterprise system for I/O being added to DDC control system for use by enterprise system operators.
 - b. Limited assistance during commissioning to extent of DDC system integration with existing enterprise system.
 - c. Prepare on-site demonstration mockup of integration of DDC system to be installed with existing system before installing DDC system.
3. Engage Owner's control system integrator to provide the following services:
 - a. Enterprise system expansion and development of graphics, logs, reports, trends and other operational capabilities of enterprise system for I/O being added to DDC control system for use by enterprise system operators.
 - b. Limited assistance during commissioning to extent of DDC system integration with existing enterprise system.
 - c. Prepare on-site demonstration mockup of integration of DDC system to be installed with existing system before installing DDC system.
4. Control System Integrator Contact Information (Submit Proposed):
 - a. Company: Insert name.
 - b. Company Street Address: Insert address.
 - c. Company Contact: Insert name.
 - d. Phone Number: Insert phone number.
 - e. E-mail Address: Insert e-mail address.
5. Attend meetings with control system integrator to integrate DDC system.

3.4 CONTROL DEVICES FOR INSTALLATION BY INSTALLERS

- A. Deliver selected control devices, specified in indicated HVAC instrumentation and control device Sections, to identified equipment and systems manufacturers for factory installation and to identified installers for field installation.
- B. Deliver the following to duct fabricator and Installer for installation in ductwork. Include installation instructions to Installer and supervise installation for compliance with requirements.
 - 1. DDC control dampers, which are specified in Section 230923.12 "DDC Control Dampers."
 - 2. Airflow sensors and switches, which are specified in Section 230923.14 "Flow Instruments."
 - 3. Pressure sensors, which are specified in Section 230923.23 "Pressure Instruments."

3.5 CONTROL DEVICES FOR EQUIPMENT MANUFACTURER FACTORY INSTALLATION

- A. Deliver the following to air-handling unit manufacturer for factory installation. Include installation instructions to air-handling unit manufacturer and supervise installation for compliance with requirements.
 - 1. Application-specific controller.

3.6 GENERAL INSTALLATION REQUIREMENTS

- A. Install products to satisfy more stringent of all requirements indicated.
- B. Install products level, plumb, parallel, and perpendicular with building construction.
- C. Support products, tubing, piping wiring and raceways. Brace products to prevent lateral movement and sway or a break in attachment.
- D. If codes and referenced standards are more stringent than requirements indicated, comply with requirements in codes and referenced standards.
- E. Fabricate openings and install sleeves in ceilings, floors, roof, and walls required by installation of products. Before proceeding with drilling, punching, and cutting, check for concealed work to avoid damage. Patch, flash, grout, seal, and refinish openings to match adjacent condition.
- F. Firestop Penetrations Made in Fire-Rated Assemblies: Comply with requirements in Section 078413 "Penetration Firestopping."
- G. Seal penetrations made in acoustically rated assemblies. Comply with requirements in Section 079200 "Joint Sealants."

H. Welding Requirements:

1. Restrict welding and burning to supports and bracing.
2. No equipment shall be cut or welded without approval. Welding or cutting will not be approved if there is risk of damage to adjacent Work.
3. Welding, where approved, shall be by inert-gas electric arc process and shall be performed by qualified welders according to applicable welding codes.
4. If requested on-site, show satisfactory evidence of welder certificates indicating ability to perform welding work intended.

I. Fastening Hardware:

1. Stillson wrenches, pliers, and other tools that damage surfaces of rods, nuts, and other parts are prohibited for work of assembling and tightening fasteners.
2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
3. Lubricate threads of bolts, nuts and screws with graphite and oil before assembly.

J. If product locations are not indicated, install products in locations that are accessible and that will permit service and maintenance from floor, equipment platforms, or catwalks without removal of permanently installed furniture and equipment.

3.7 SERVER INSTALLATION

- A. Install one server(s) at location(s) directed by Owner.
- B. Install number of servers required to suit requirements indicated. Review Project requirements and indicate layout of proposed location in Shop Drawings.
- C. Install software indicated on server(s) and verify that software functions properly.
- D. Develop Project-specific graphics, trends, reports, logs, and historical database.
- E. Power servers through dedicated UPS unit. Locate UPS adjacent to server.

3.8 CONTROLLER INSTALLATION

- A. Install controllers in enclosures to comply with indicated requirements.
- B. Connect controllers to field power supply and to UPS units where indicated.
- C. Install controller with latest version of applicable software and configure to execute requirements indicated.
- D. Test and adjust controllers to verify operation of connected I/O to achieve performance indicated requirements while executing sequences of operation.
- E. Installation of Network Controllers:

1. Quantity and location of network controllers shall be determined by DDC system manufacturer to satisfy requirements indicated.
2. Install controllers in a protected location that is easily accessible by operators.
3. Top of controller shall be within 72 inches of finished floor.

F. Installation of Programmable Application Controllers:

1. Quantity and location of programmable application controllers shall be determined by DDC system manufacturer to satisfy requirements indicated.
2. Install controllers in a protected location that is easily accessible by operators.
3. Top of controller shall be within 72 inches of finished floor.

G. Application-Specific Controllers:

1. Quantity and location of application-specific controllers shall be determined by DDC system manufacturer to satisfy requirements indicated.
2. For controllers not mounted directly on equipment being controlled, install controllers in a protected location that is easily accessible by operators.

3.9 INSTALLATION OF WIRELESS ROUTERS FOR OPERATOR INTERFACE

- A. Install wireless routers to achieve optimum performance and best possible coverage.
- B. Mount wireless routers in a protected location that is within 60 inches of floor and easily accessible by operators.
- C. Connect wireless routers to field power supply and to UPS units if network controllers are powered through UPS units.
- D. Install wireless router with latest version of applicable software and configure wireless router with WPA2 security and password protection. Create access password with not less than 12 characters consisting of letters and numbers and at least one special character. Document password in operations and maintenance manuals for reference by operators.
- E. Test and adjust wireless routers for proper operation with portable workstation and other wireless devices intended for use by operators.

3.10 ENCLOSURES INSTALLATION

- A. Install the following items in enclosures, to comply with indicated requirements:
 1. Controllers.
 2. Electrical power devices.
 3. UPS units.
 4. Relays.
- B. Attach wall-mounted enclosures to wall using the following types of steel struts:

1. For NEMA 250, Type 1 Enclosures: Use corrosion-resistant-coated steel strut and hardware.
 2. For NEMA 250, Type 4X Enclosures and Enclosures Located Outdoors: Use stainless-steel strut and hardware.
 3. Install plastic caps on exposed cut edges of strut.
- C. Align top or bottom of adjacent enclosures of like size.
- D. Install floor-mounted enclosures located in mechanical equipment rooms on concrete housekeeping pads. Attach enclosure legs using stainless-steel anchors.
- E. Install continuous and fully accessible wireways to connect conduit, wire, and cable to multiple adjacent enclosures. Wireway used for application shall have protection equal to NEMA 250 rating of connected enclosures.

3.11 ELECTRIC POWER CONNECTIONS

- A. Connect electrical power to DDC system products requiring electrical power connections.
- B. Design of electrical power to products not indicated with electric power is delegated to DDC system provider and installing trade. Work shall comply with NFPA 70 and other requirements indicated.
- C. Comply with requirements in Section 262816 "Enclosed Switches and Circuit Breakers" for electrical power circuit breakers.
- D. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical power conductors and cables.
- E. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for electrical power raceways and boxes.

3.12 NETWORK INSTALLATION

- A. Install balanced twisted pair or optical fiber cable when connecting between the following network devices located in same building:
1. Network controllers.
- B. Install balanced twisted pair or copper cable (as required by equipment) when connecting between the following:
1. Network controllers and programmable application controllers.
 2. Programmable application controllers.
 3. Programmable application controllers and application-specific controllers.
 4. Application-specific controllers.
- C. Install cable in continuous raceway.

1. Where indicated on Drawings, cable trays may be used for copper cable in lieu of conduit.

3.13 NETWORK NAMING AND NUMBERING

- A. Coordinate with Owner and provide unique naming and addressing for networks and devices.
- B. ASHRAE 135 Networks:
 1. MAC Address:
 - a. Every network device shall have an assigned and documented MAC address unique to its network.
 - b. Ethernet Networks: Document MAC address assigned at its creation.
 - c. ARCNET or MS/TP networks: Assign from 00 to 64.
 2. Network Numbering:
 - a. Assign unique numbers to each new network.
 - b. Provide ability for changing network number through device switches or operator interface.
 - c. DDC system, with all possible connected LANs, can contain up to 65,534 unique networks.
 3. Device Object Identifier Property Number:
 - a. Assign unique device object identifier property numbers or device instances for each device network.
 - b. Provide for future modification of device instance number by device switches or operator interface.
 - c. LAN shall support up to 4,194,302 unique devices.
 4. Device Object Name Property Text:
 - a. Device object name property field shall support 32 minimum printable characters.
 - b. Assign unique device "Object Name" property names with plain-English descriptive names for each device.
 - 1) Example 1: Device object name for device controlling boiler plant at Building 1000 would be "HW System B1000."
 - 2) Example 2: Device object name for a VAV terminal unit controller could be "VAV unit 102".
 5. Object Name Property Text for Other Than Device Objects:
 - a. Object name property field shall support 32 minimum printable characters.
 - b. Assign object name properties with plain-English names descriptive of application.

- 1) Example 1: "Zone 1 Temperature."
- 2) Example 2 "Fan Start and Stop."

6. Object Identifier Property Number for Other Than Device Objects:

- a. Assign object identifier property numbers according to Drawings or tables indicated.
- b. If not indicated, object identifier property numbers may be assigned at Installer's discretion but must be approved by Owner in advance, be documented and be unique for like object types within device.

3.14 CONTROL WIRE, CABLE AND RACEWAYS INSTALLATION

A. Comply with NECA 1.

B. Wire and Cable Installation:

1. Comply with installation requirements in Section 260523 "Control-Voltage Electrical Power Cables."
2. Comply with installation requirements in Section 271313 "Communications Copper Backbone Cabling."
3. Comply with installation requirements in Section 271513 "Communications Copper Horizontal Cabling."
4. Install cables with protective sheathing that is waterproof and capable of withstanding continuous temperatures of 90 deg C with no measurable effect on physical and electrical properties of cable.
 - a. Provide shielding to prevent interference and distortion from adjacent cables and equipment.
5. Terminate wiring in a junction box.
 - a. Clamp cable over jacket in junction box.
 - b. Individual conductors in the stripped section of the cable shall be slack between the clamping point and terminal block.
6. Terminate field wiring and cable not directly connected to instruments and control devices having integral wiring terminals using terminal blocks.
7. Install signal transmission components according to IEEE C2, REA Form 511a, NFPA 70, and as indicated.
8. Use shielded cable to transmitters.
9. Use shielded cable to temperature sensors.
10. Perform continuity and meager testing on wire and cable after installation.

C. Conduit Installation:

1. Comply with Section "260533 "Raceways and Boxes for Electrical Systems" for control-voltage conductors.
2. Comply with Section 270528 "Pathways for Communications Systems" for balanced twisted pair cabling and optical fiber installation.

3.15 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and installations, including connections.
- C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Testing:
 - 1. Perform preinstallation, in-progress, and final tests, supplemented by additional tests, as necessary.
 - 2. Preinstallation Cable Verification: Verify integrity and serviceability for new cable lengths before installation. This assurance may be provided by using vendor verification documents, testing, or other methods. As a minimum, furnish evidence of verification for cable attenuation and bandwidth parameters.
 - 3. In-Progress Testing: Perform standard tests for correct pair identification and termination during installation to ensure proper installation and cable placement. Perform tests in addition to those specified if there is any reason to question condition of material furnished and installed. Testing accomplished is to be documented by agency conducting tests. Submit test results for Project record.
 - 4. Final Testing: Perform final test of installed system to demonstrate acceptability as installed. Testing shall be performed according to a test plan supplied by DDC system manufacturer. Defective Work or material shall be corrected and retested. As a minimum, final testing for cable system, including spare cable, shall verify conformance of attenuation, length, and bandwidth parameters with performance indicated.
 - 5. Test Equipment: Use an optical fiber time domain reflectometer for testing of length and optical connectivity.
 - 6. Test Results: Record test results and submit copy of test results for Project record.

3.16 DDC SYSTEM I/O CHECKOUT PROCEDURES

- A. Check installed products before continuity tests, leak tests and calibration.
- B. Check instruments for proper location and accessibility.
- C. Check instruments for proper installation on direction of flow, elevation, orientation, insertion depth, or other applicable considerations that will impact performance.

- D. Check instrument tubing for proper isolation, fittings, slope, dirt legs, drains, material and support.
- E. Control Damper Checkout:
 - 1. Verify that proper blade alignment, either parallel or opposed, has been provided.
 - 2. Verify that actuator wiring is complete, enclosed and connected to correct power source.
- F. Instrument Checkout:
 - 1. Verify that instrument is correctly installed for location, orientation, direction and operating clearances.
 - 2. Verify that attachment is properly secured and sealed.
 - 3. Verify that conduit connections are properly secured and sealed.
 - 4. Verify that wiring is properly labeled with unique identification, correct type and size and is securely attached to proper terminals.
 - 5. Inspect instrument tag against approved submittal.
 - 6. For instruments with tubing connections, verify that tubing attachment is secure and isolation valves have been provided.
 - 7. For flow instruments, verify that recommended upstream and downstream distances have been maintained.
 - 8. For temperature instruments:
 - a. Verify sensing element type and proper material.
 - b. Verify length and insertion.

3.17 DDC SYSTEM I/O ADJUSTMENT, CALIBRATION AND TESTING:

- A. Calibrate each instrument installed that is not factory calibrated and provided with calibration documentation.
- B. Provide a written description of proposed field procedures and equipment for calibrating each type of instrument. Submit procedures before calibration and adjustment.
- C. For each analog instrument, make a three-point test of calibration for both linearity and accuracy.
- D. Equipment and procedures used for calibration shall comply with instrument manufacturer's written instructions.
- E. Provide diagnostic and test equipment for calibration and adjustment.
- F. Field instruments and equipment used to test and calibrate installed instruments shall have accuracy at least twice the instrument accuracy being calibrated. An installed instrument with an accuracy of 1 percent shall be checked by an instrument with an accuracy of 0.5 percent.

- G. Calibrate each instrument according to instrument instruction manual supplied by manufacturer.
- H. If after calibration indicated performance cannot be achieved, replace out-of-tolerance instruments.
- I. Comply with field testing requirements and procedures indicated by ASHRAE's Guideline 11, "Field Testing of HVAC Control Components," in the absence of specific requirements, and to supplement requirements indicated.
- J. Analog Signals:
 - 1. Check analog voltage signals using a precision voltage meter at zero, 50, and 100 percent.
 - 2. Check analog current signals using a precision current meter at zero, 50, and 100 percent.
 - 3. Check resistance signals for temperature sensors at zero, 50, and 100 percent of operating span using a precision-resistant source.
- K. Digital Signals:
 - 1. Check digital signals using a jumper wire.
 - 2. Check digital signals using an ohmmeter to test for contact making or breaking.
- L. Control Dampers:
 - 1. Stroke and adjust control dampers following manufacturer's recommended procedure, from 100 percent open to 100 percent closed and back to 100 percent open.
 - 2. Stroke control dampers with pilot positioners. Adjust damper and positioner following manufacturer's recommended procedure, so damper is 100 percent closed, 50 percent closed and 100 percent open at proper air pressure.
 - 3. Check and document open and close cycle times for applications with a cycle time less than 30 seconds.
 - 4. For control dampers equipped with positive position indication, check feedback signal at multiple positions to confirm proper position indication.
- M. Sensors: Check sensors at zero, 50, and 100 percent of Project design values.
- N. Switches: Calibrate switches to make or break contact at set points indicated.
- O. Transmitters:
 - 1. Check and calibrate transmitters at zero, 50, and 100 percent of Project design values.
 - 2. Calibrate resistance temperature transmitters at zero, 50, and 100 percent of span using a precision-resistant source.

3.18 DDC SYSTEM CONTROLLER CHECKOUT

- A. Verify power supply.
 - 1. Verify voltage, phase and hertz.
 - 2. Verify that protection from power surges is installed and functioning.
 - 3. Verify that ground fault protection is installed.
 - 4. If applicable, verify if connected to UPS unit.
 - 5. If applicable, verify that power conditioning units, transient voltage suppression and high-frequency noise filter units are installed.
- B. Verify that wire and cabling is properly secured to terminals and labeled with unique identification.
- C. Verify that spare I/O capacity is provided.

3.19 DDC CONTROLLER I/O CONTROL LOOP TESTS

- A. Testing:
 - 1. Test every I/O point connected to DDC controller to verify that safety and operating control set points are as indicated and as required to operate controlled system safely and at optimum performance.
 - 2. Test every I/O point throughout its full operating range.
 - 3. Test every control loop to verify operation is stable and accurate.
 - 4. Adjust control loop proportional, integral and derivative settings to achieve optimum performance while complying with performance requirements indicated. Document testing of each control loop's precision and stability via trend logs.
 - 5. Test and adjust every control loop for proper operation according to sequence of operation.
 - 6. Test software and hardware interlocks for proper operation. Correct deficiencies.
 - 7. Operate each analog point at the following:
 - a. Upper quarter of range.
 - b. Lower quarter of range.
 - c. At midpoint of range.
 - 8. Exercise each binary point.
 - 9. For every I/O point in DDC system, read and record each value at operator workstation, at DDC controller and at field instrument simultaneously. Value displayed at operator workstation, at DDC controller and at field instrument shall match.
 - 10. Prepare and submit a report documenting results for each I/O point in DDC system and include in each I/O point a description of corrective measures and adjustments made to achieve desired results.

3.20 DDC SYSTEM VALIDATION TESTS

- A. Perform validation tests before requesting final review of system. Before beginning testing, first submit Pretest Checklist and Test Plan.
- B. After approval of Test Plan, execute all tests and procedures indicated in plan.
- C. After testing is complete, submit completed test checklist.
- D. Pretest Checklist: Submit the following list with items checked off once verified:
 - 1. Detailed explanation for any items that are not completed or verified.
 - 2. Required mechanical installation work is successfully completed and HVAC equipment is working correctly.
 - 3. HVAC equipment motors operate below full-load amperage ratings.
 - 4. Required DDC system components, wiring, and accessories are installed.
 - 5. Installed DDC system architecture matches approved Drawings.
 - 6. Control electric power circuits operate at proper voltage and are free from faults.
 - 7. Required surge protection is installed.
 - 8. DDC system network communications function properly, including uploading and downloading programming changes.
 - 9. Using BACnet protocol analyzer, verify that communications are error free.
 - 10. Each controller's programming is backed up.
 - 11. Equipment, products, tubing, wiring cable and conduits are properly labeled.
 - 12. All I/O points are programmed into controllers.
 - 13. Testing, adjusting and balancing work affecting controls is complete.
 - 14. Dampers and actuators zero and span adjustments are set properly.
 - 15. Each control damper and actuator goes to failed position on loss of power.
 - 16. Meter, sensor and transmitter readings are accurate and calibrated.
 - 17. Control loops are tuned for smooth and stable operation.
 - 18. View trend data where applicable.
 - 19. Each controller works properly in standalone mode.
 - 20. Safety controls and devices function properly.
 - 21. Interfaces with fire-alarm system function properly.
 - 22. Electrical interlocks function properly.
 - 23. Operator workstations and other interfaces are delivered, all system and database software is installed, and graphic are created.
 - 24. Record Drawings are completed.
- E. Test Plan:
 - 1. Prepare and submit a validation test plan including test procedures for performance validation tests.
 - 2. Test plan shall address all specified functions of DDC system and sequences of operation.
 - 3. Explain detailed actions and expected results to demonstrate compliance with requirements indicated.
 - 4. Explain method for simulating necessary conditions of operation used to demonstrate performance.

5. Include a test checklist to be used to check and initial that each test has been successfully completed.
6. Submit test plan documentation 10 business days before start of tests.

F. Validation Test:

1. Verify operating performance of each I/O point in DDC system.
 - a. Verify analog I/O points at operating value.
 - b. Make adjustments to out-of-tolerance I/O points.
 - 1) Identify I/O points for future reference.
 - 2) Simulate abnormal conditions to demonstrate proper function of safety devices.
 - 3) Replace instruments and controllers that cannot maintain performance indicated after adjustments.
2. Simulate conditions to demonstrate proper sequence of control.
3. Readjust settings to design values and observe ability of DDC system to establish desired conditions.
4. After 24 Hours following Initial Validation Test:
 - a. Re-check I/O points that required corrections during initial test.
 - b. Identify I/O points that still require additional correction and make corrections necessary to achieve desired results.
5. After 24 Hours of Second Validation Test:
 - a. Re-check I/O points that required corrections during second test.
 - b. Continue validation testing until I/O point is normal on two consecutive tests.
6. Completely check out, calibrate, and test all connected hardware and software to ensure that DDC system performs according to requirements indicated.
7. After validation testing is complete, prepare and submit a report indicating all I/O points that required correction and how many validation re-tests it took to pass. Identify adjustments made for each test and indicate instruments that were replaced.

G. DDC System Response Time Test:

1. Simulate HLC.
 - a. Heavy load shall be an occurrence of 50 percent of total connected binary COV, one-half of which represent an "alarm" condition, and 50 percent of total connected analog COV, one-half of which represent an "alarm" condition, that are initiated simultaneously on a one-time basis.
2. Initiate 10 successive occurrences of HLC and measure response time to typical alarms and status changes.

3. Measure with a timer having at least 0.1-second resolution and 0.01 percent accuracy.
4. Purpose of test is to demonstrate DDC system, as follows:
 - a. Reaction to COV and alarm conditions during HLC.
 - b. Ability to update DDC system database during HLC.
5. Passing test is contingent on the following:
 - a. Alarm reporting at printer beginning no more than two seconds after the initiation (time zero) of HLC.
 - b. All alarms, both binary and analog, are reported and printed; none are lost.
 - c. Compliance with response times specified.
6. Prepare and submit a report documenting HLC tested and results of test including time stamp and print out of all alarms.

H. DDC System Network Bandwidth Test:

1. Test network bandwidth usage on all DDC system networks to demonstrate bandwidth usage under DDC system normal operating conditions and under simulated HLC.
2. To pass, none of DDC system networks shall use more than 70 percent of available bandwidth under normal and HLC operation.

3.21 FINAL REVIEW

- A. Submit written request to Architect and Construction Manager when DDC system is ready for final review. Written request shall state the following:
 1. DDC system has been thoroughly inspected for compliance with contract documents and found to be in full compliance.
 2. DDC system has been calibrated, adjusted and tested and found to comply with requirements of operational stability, accuracy, speed and other performance requirements indicated.
 3. DDC system monitoring and control of HVAC systems results in operation according to sequences of operation indicated.
 4. DDC system is complete and ready for final review.
- B. Review by Architect and Construction Manager shall be made after receipt of written request. A field report shall be issued to document observations and deficiencies.
- C. Take prompt action to remedy deficiencies indicated in field report and submit a second written request when all deficiencies have been corrected. Repeat process until no deficiencies are reported.

- D. Should more than two reviews be required, DDC system manufacturer and Installer shall compensate entity performing review for total costs, labor and expenses, associated with third and subsequent reviews. Estimated cost of each review shall be submitted and approved by DDC system manufacturer and Installer before making the review.
- E. Prepare and submit closeout submittals and begin procedures indicated in "Extended Operation Test" Article when no deficiencies are reported.
- F. A part of DDC system final review shall include a demonstration to parties participating in final review.
 - 1. Provide staff familiar with DDC system installed to demonstrate operation of DDC system during final review.
 - 2. Provide testing equipment to demonstrate accuracy and other performance requirements of DDC system that is requested by reviewers during final review.
 - 3. Demonstration shall include, but not be limited to, the following:
 - a. Accuracy and calibration of 10 I/O points randomly selected by reviewers. If review finds that some I/O points are not properly calibrated and not satisfying performance requirements indicated, additional I/O points may be selected by reviewers until total I/O points being reviewed that satisfy requirements equals quantity indicated.
 - b. HVAC equipment and system hardwired and software safeties and life-safety functions are operating according to sequence of operation. Up to 10 I/O points shall be randomly selected by reviewers. Additional I/O points may be selected by reviewers to discover problems with operation.
 - c. Correct sequence of operation after electrical power interruption and resumption after electrical power is restored for randomly selected HVAC systems.
 - d. Operation of randomly selected dampers and valves in normal-on, normal-off and failed positions.
 - e. Reporting of alarm conditions for randomly selected alarms, including different classes of alarms, to ensure that alarms are properly received by operators and operator workstations.
 - f. Trends, summaries, logs and reports set-up for Project.
 - g. For up to three HVAC systems randomly selected by reviewers, use graph trends to show that sequence of operation is executed in correct manner and that HVAC systems operate properly through complete sequence of operation including different modes of operations indicated. Show that control loops are stable and operating at set points and respond to changes in set point of 20 percent or more.
 - h. Software's ability to communicate with controllers, operator workstations, uploading and downloading of control programs.
 - i. Software's ability to edit control programs off-line.
 - j. Data entry to show Project-specific customizing capability including parameter changes.
 - k. Step through penetration tree, display all graphics, demonstrate dynamic update, and direct access to graphics.
 - l. Execution of digital and analog commands in graphic mode.

- m. Spreadsheet and curve plot software and its integration with database.
- n. Online user guide and help functions.
- o. Multitasking by showing different operations occurring simultaneously on four quadrants of split screen.
- p. System speed of response compared to requirements indicated.
- q. For Each Network Controller:
 - 1) Memory: Programmed data, parameters, trend and alarm history collected during normal operation is not lost during power failure.
 - 2) Operator Interface: Ability to connect directly to each type of digital controller with a portable workstation and mobile device. Show that maintenance personnel interface tools perform as indicated in manufacturer's technical literature.
 - 3) Standalone Ability: Demonstrate that controllers provide stable and reliable standalone operation using default values or other method for values normally read over network.
 - 4) Electric Power: Ability to disconnect any controller safely from its power source.
 - 5) Wiring Labels: Match control drawings.
 - 6) Network Communication: Ability to locate a controller's location on network and communication architecture matches Shop Drawings.
 - 7) Nameplates and Tags: Accurate and permanently attached to control panel doors, instrument, actuators and devices.
- r. For Each Server or Operator Workstation:
 - 1) I/O points lists agree with naming conventions.
 - 2) Graphics are complete.
 - 3) UPS unit, if applicable, operates.
- s. Communications and Interoperability: Demonstrate proper interoperability of data sharing, alarm and event management, trending, scheduling, and device and network management. Use ASHRAE 135 protocol analyzer to help identify devices, view network traffic, and verify interoperability. Requirements must be met even if only one manufacturer's equipment is installed.
 - 1) Data Presentation: On each operator workstation, demonstrate graphic display capabilities.
 - 2) Reading of Any Property: Demonstrate ability to read and display any used readable object property of any device on network.
 - 3) Set Point and Parameter Modifications: Show ability to modify set points and tuning parameters indicated. Modifications are made with messages and write services initiated by an operator using workstation graphics, or by completing a field in a menu with instructional text.
 - 4) Peer-to-Peer Data Exchange: Network devices are installed and configured to perform without need for operator intervention to implement Project sequence of operation and to share global data.

- 5) Alarm and Event Management: Alarms and events are installed and prioritized according to Owner. Demonstrate that time delays and other logic are set up to avoid nuisance tripping. Show that operators with sufficient privileges are permitted.
- 6) Schedule Lists: Schedules are configured for start and stop, mode change, occupant overrides, and night setback as defined in sequence of operations.
- 7) Schedule Display and Modification: Ability to display any schedule with start and stop times for calendar year. Show that all calendar entries and schedules are modifiable from any connected operator workstation by an operator with sufficient privilege.
- 8) Archival Storage of Data: Data archiving is handled by operator workstation and server and local trend archiving and display is accomplished.
- 9) Modification of Trend Log Object Parameters: Operator with sufficient privilege can change logged data points, sampling rate, and trend duration.
- 10) Device and Network Management:
 - a) Display of network device status.
 - b) Display of BACnet Object Information.
 - c) Silencing devices transmitting erroneous data.
 - d) Time synchronization.
 - e) Remote device re-initialization.
 - f) Backup and restore network device programming and master database(s).
 - g) Configuration management of routers.

3.22 EXTENDED OPERATION TEST

- A. Extended operation test is intended to simulate normal operation of DDC system by Owner.
- B. Operate DDC system for an operating period of 28 consecutive calendar days following Substantial Completion. Coordinate exact start date of testing with Owner.
- C. Provide an operator familiar with DDC system installed to man an operator workstation while on-site during eight hours of each normal business day occurring during operating period.
- D. During operating period, DDC system shall demonstrate correct operation and accuracy of monitored and controlled points as well as operation capabilities of sequences, logs, trends, reports, specialized control algorithms, diagnostics, and other software indicated.
 1. Correct defects of hardware and software when it occurs.
- E. Definition of Failures and Downtime during Operating Period:

1. Failed I/O point constituting downtime is an I/O point failing to perform its intended function consistently and a point physically failed due to hardware and software.
 2. Downtime is when any I/O point in DDC system is unable to fulfill its' required function.
 3. Downtime shall be calculated as elapsed time between a detected point failure as confirmed by an operator and time point is restored to service.
 4. Maximum time interval allowed between DDC system detection of failure occurrence and operator confirmation shall be 0.5 hours.
 5. Downtime shall be logged in hours to nearest 0.1 hour.
 6. Power outages shall not count as downtime, but shall suspend test hours unless systems are provided with UPS and served through a backup power source.
 7. Hardware or software failures caused by power outages shall count as downtime.
- F. During operating period, log downtime and operational problems are encountered.
1. Identify source of problem.
 2. Provide written description of corrective action taken.
 3. Record duration of downtime.
 4. Maintain log showing the following:
 - a. Time of occurrence.
 - b. Description of each occurrence and pertinent written comments for reviewer to understand scope and extent of occurrence.
 - c. Downtime for each failed I/O point.
 - d. Running total of downtime and total time of I/O point after each problem has been restored.
 5. Log shall be available to Owner for review at any time.
- G. For DDC system to pass extended operation test, total downtime shall not exceed 1 percent of total point-hours during operating period.
1. Failure to comply with minimum requirements of passing at end of operating period indicated shall require that operating period be extended one consecutive day at a time until DDC system passes requirement.
- H. Evaluation of DDC system passing test shall be based on the following calculation:
1. Downtime shall be counted on a point-hour basis where total number of DDC system point-hours is equal to total number of I/O points in DDC system multiplied by total number of hours during operating period.
 2. One point-hour of downtime is one I/O point down for one hour. Three points down for five hours is a total of 15 point-hours of downtime. Four points down for one-half hour is 2 point-hours of downtime.
 3. Example Calculation: Maximum allowable downtime for 30-day test when DDC system has 1000 total I/O points (combined analog and binary) and has passing score of 1 percent downtime is computed by 30 days x 24 h/day x 1000 points x 1 percent equals 7200 point-hours of maximum allowable downtime.

- I. Prepare test and inspection reports.

3.23 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.24 MAINTENANCE SERVICE

- A. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by DDC system manufacturer's authorized service representative. Include semiannual preventive maintenance, repair or replacement of worn or defective components, cleaning, calibration and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.25 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two year(s).
- B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two year(s) from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
 - 1. Upgrade Notice: At least 30 days to allow Owner to schedule and access system and to upgrade computer equipment if necessary.

3.26 DEMONSTRATION

- A. Engage a factory-authorized service representative with complete knowledge of Project-specific system installed to train Owner's maintenance personnel to adjust, operate, and maintain DDC system.
- B. Extent of Training:
 - 1. Base extent of training on scope and complexity of DDC system indicated and training requirements indicated. Provide extent of training required to satisfy requirements indicated even if more than minimum training requirements are indicated.
 - 2. Inform Owner of anticipated training requirements if more than minimum training requirements are indicated.
 - 3. Minimum Training Requirements:

- a. Provide not less than 10 days of training total.
- b. Stagger training over multiple training classes to accommodate Owner's requirements. All training shall occur before end of warranty period.
- c. Total days of training shall be broken into not more than two separate training classes.
- d. Each training class shall be not less than one consecutive day(s).

C. Training Schedule:

1. Schedule training with Owner 20 business days before expected Substantial Completion.
2. Schedule training to provide Owner with at least 20 business days of notice in advance of training.
3. Training shall occur within normal business hours at a mutually agreed on time. Unless otherwise agreed to, training shall occur Monday through Friday, except on U.S. Federal holidays, with two morning sessions and two afternoon sessions. Each morning session and afternoon session shall be split in half with 15 -minute break between sessions. Morning and afternoon sessions shall be separated by 60 -minute lunch period. Training, including breaks and excluding lunch period, shall not exceed eight hours per day.
4. Provide staggered training schedule as requested by Owner.

D. Training Attendee List and Sign-in Sheet:

1. Request from Owner in advance of training a proposed attendee list with name, phone number and e-mail address.
2. Provide a preprinted sign-in sheet for each training session with proposed attendees listed and no fewer than six blank spaces to add additional attendees.
3. Preprinted sign-in sheet shall include training session number, date and time, instructor name, phone number and e-mail address, and brief description of content to be covered during session. List attendees with columns for name, phone number, e-mail address and a column for attendee signature or initials.
4. Circulate sign-in sheet at beginning of each session and solicit attendees to sign or initial in applicable location.
5. At end of each training day, send Owner an e-mail with an attachment of scanned copy (PDF) of circulated sign-in sheet for each session.

E. Training Attendee Headcount:

1. Plan in advance of training for five attendees.
2. Make allowance for Owner to add up to two attendee(s) at time of training.
3. Headcount may vary depending on training content covered in session. Attendee access may be restricted to some training content for purposes of maintaining system security.

F. Training Attendee Prior Knowledge: For guidance in planning required training and instruction, assume attendees have the following:

1. High school and four-year college education and degree.
2. Advanced user knowledge of computers and office applications.

3. Intermediate knowledge of HVAC systems.
4. Advanced knowledge of DDC systems.
5. Advanced knowledge of DDC system and products installed.

G. Attendee Training Manuals:

1. Provide each attendee with a color hard copy of all training materials and visual presentations.
2. Hard-copy materials shall be organized in a three-ring binder with table of contents and individual divider tabs marked for each logical grouping of subject matter. Organize material to provide space for attendees to take handwritten notes within training manuals.
3. In addition to hard-copy materials included in training manual, provide each binder with a sleeve or pocket that includes a DVD or flash drive with PDF copy of all hard-copy materials.

H. Instructor Requirements:

1. One or multiple qualified instructors, as required, to provide training.
2. Instructors shall have not less than five years of providing instructional training on not less than five past projects with similar DDC system scope and complexity to DDC system installed.

I. Organization of Training Sessions:

1. Organize training sessions into logical groupings of technical content and to reflect different levels of operators having access to system. Plan training sessions to accommodate the following three levels of operators:
 - a. Daily operators.
 - b. Advanced operators.
 - c. System managers and administrators.
2. Plan and organize training sessions to group training content to protect DDC system security. Some attendees may be restricted to some training sessions that cover restricted content for purposes of maintaining DDC system security.

J. Training Outline:

1. Submit training outline for Owner review at least 10 business day before scheduling training.
2. Outline shall include a detailed agenda for each training day that is broken down into each of four training sessions that day, training objectives for each training session and synopses for each lesson planned.

K. On-Site Training:

1. Owner will provide conditioned classroom or workspace with ample desks or tables, chairs, power and data connectivity for instructor and each attendee.
2. Instructor shall provide training materials, projector and other audiovisual equipment used in training.

3. Provide as much of training located on-site as deemed feasible and practical by Owner.
4. On-site training shall include regular walk-through tours, as required, to observe each unique product type installed with hands-on review of operation, calibration and service requirements.
5. Operator workstation provided with DDC system shall be used in training. If operator workstation is not indicated, provide a temporary workstation to convey training content.

L. Off-Site Training:

1. Provide conditioned training rooms and workspace with ample tables desks or tables, chairs, power and data connectivity for each attendee.
2. Provide capability to remotely access to Project DDC system for use in training.
3. Provide a workstation for use by each attendee.

M. Training Content for Daily Operators:

1. Basic operation of system.
2. Understanding DDC system architecture and configuration.
3. Understanding each unique product type installed including performance and service requirements for each.
4. Understanding operation of each system and equipment controlled by DDC system including sequences of operation, each unique control algorithm and each unique optimization routine.
5. Operating operator workstations, printers and other peripherals.
6. Logging on and off system.
7. Accessing graphics, reports and alarms.
8. Adjusting and changing set points and time schedules.
9. Recognizing DDC system malfunctions.
10. Understanding content of operation and maintenance manuals including control drawings.
11. Understanding physical location and placement of DDC controllers and I/O hardware.
12. Accessing data from DDC controllers.
13. Operating portable operator workstations.
14. Review of DDC testing results to establish basic understanding of DDC system operating performance and HVAC system limitations as of Substantial Completion.
15. Running each specified report and log.
16. Displaying and demonstrating each data entry to show Project-specific customizing capability. Demonstrating parameter changes.
17. Stepping through graphics penetration tree, displaying all graphics, demonstrating dynamic updating, and direct access to graphics.
18. Executing digital and analog commands in graphic mode.
19. Demonstrating control loop precision and stability via trend logs of I/O for not less than 10 percent of I/O installed.
20. Demonstrating DDC system performance through trend logs and command tracing.
21. Demonstrating scan, update, and alarm responsiveness.

22. Demonstrating spreadsheet and curve plot software, and its integration with database.
23. Demonstrating on-line user guide, and help function and mail facility.
24. Demonstrating multitasking by showing dynamic curve plot, and graphic construction operating simultaneously via split screen.
25. Demonstrating the following for HVAC systems and equipment controlled by DDC system:
 - a. Operation of HVAC equipment in normal-off, -on and failed conditions while observing individual equipment, dampers and valves for correct position under each condition.
 - b. For HVAC equipment with factory-installed software, show that integration into DDC system is able to communicate with DDC controllers or gateways, as applicable.
 - c. Using graphed trends, show that sequence of operation is executed in correct manner, and HVAC systems operate properly through complete sequence of operation including seasonal change, occupied and unoccupied modes, warm-up and cool-down cycles and other modes of operation indicated.
 - d. Hardware interlocks and safeties function properly and DDC system performs correct sequence of operation after electrical power interruption and resumption after power is restored.
 - e. Reporting of alarm conditions for each alarm, and confirm that alarms are received at assigned locations, including operator workstations.
 - f. Each control loop responds to set point adjustment and stabilizes within time period indicated.
 - g. Sharing of previously graphed trends of all control loops to demonstrate that each control loop is stable and set points are being maintained.
26. Insert requirement.

N. Training Content for Advanced Operators:

1. Making and changing workstation graphics.
2. Creating, deleting and modifying alarms including annunciation and routing.
3. Creating, deleting and modifying point trend logs including graphing and printing on an ad-hoc basis and operator-defined time intervals.
4. Creating, deleting and modifying reports.
5. Creating, deleting and modifying points.
6. Creating, deleting and modifying programming including ability to edit control programs off-line.
7. Creating, deleting and modifying system graphics and other types of displays.
8. Adding DDC controllers and other network communication devices such as gateways and routers.
9. Adding operator workstations.
10. Performing DDC system checkout and diagnostic procedures.
11. Performing DDC controllers operation and maintenance procedures.
12. Performing operator workstation operation and maintenance procedures.
13. Configuring DDC system hardware including controllers, workstations, communication devices and I/O points.

14. Maintaining, calibrating, troubleshooting, diagnosing and repairing hardware.
15. Adjusting, calibrating and replacing DDC system components.
16. Insert requirement.

O. Training Content for System Managers and Administrators:

1. DDC system software maintenance and backups.
2. Uploading, downloading and off-line archiving of all DDC system software and databases.
3. Interface with Project-specific, third-party operator software.
4. Understanding password and security procedures.
5. Adding new operators and making modifications to existing operators.
6. Operator password assignments and modification.
7. Operator authority assignment and modification.
8. Workstation data segregation and modification.
9. Insert requirement.

P. Video of Training Sessions:

1. Provide a digital video and audio recording of each training session. Create a separate recording file for each session.
2. Stamp each recording file with training session number, session name and date.
3. Provide Owner with two copies of digital files on DVDs or flash drives for later reference and for use in future training.
4. Owner retains right to make additional copies for intended training purposes without having to pay royalties.

END OF SECTION 230923

SECTION 230993.11 - SEQUENCE OF OPERATIONS FOR HVAC DDC

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 control sequences for DDC for HVAC systems, subsystems, and equipment.

1.3 DEFINITIONS

- A. Analog Output: Proportional output signal (zero- to 10-V dc, 4 to 20 mA).
- B. Binary Output: On/off output signal or contact closure.
- C. DDC: Direct digital control.
- D. Digital Output: Data output that must be interpreted digitally.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230993.11

SECTION 231123 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipes, tubes, and fittings.
 - 2. Piping specialties.
 - 3. Piping and tubing joining materials.
 - 4. Manual gas shutoff valves.
 - 5. Earthquake valves.
 - 6. Pressure regulators.

1.3 DEFINITIONS

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
 - 1. Piping specialties.
 - 2. Corrugated, stainless-steel tubing with associated components.
 - 3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
 - 4. Pressure regulators. Indicate pressure ratings and capacities.
 - 5. Dielectric fittings.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified professional engineer.
- B. Welding certificates.
- C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For pressure regulators to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.
- B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

1.9 PROJECT CONDITIONS

- A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.
- B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of natural-gas service.
2. Do not proceed with interruption of natural-gas service without Architect's written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
 1. Piping and Valves: 100 psig minimum unless otherwise indicated.
 2. Service Regulators: 65 psig minimum unless otherwise indicated.
- B. Natural-Gas System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 2 psig but not more than 5 psig, and is reduced to secondary pressure of more than 0.5 psig but not more than 2 psig.
- C. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

2.2 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A53/A53M, black steel, Schedule 40, Type E or S, Grade B.
 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 2. Wrought-Steel Welding Fittings: ASTM A234/A234M for butt welding and socket welding.
 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - a. Material Group: 1.1.
 - b. End Connections: Threaded or butt welding to match pipe.
 - c. Lapped Face: Not permitted underground.
 - d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
 - e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.
 5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
 - a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

6. Mechanical Couplings:

- 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) GE Oil & Gas.
 - 2) Smith-Blair, Inc.
- b. Steel flanges and tube with epoxy finish.
- c. Buna-nitrile seals.
- d. Steel bolts, washers, and nuts.
- e. Coupling shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
- f. Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.

2.3 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

- 1. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
- 2. Corrugated stainless-steel tubing with polymer coating.
- 3. Operating-Pressure Rating: 0.5 psig.
- 4. End Fittings: Zinc-coated steel.
- 5. Threaded Ends: Comply with ASME B1.20.1.
- 6. Maximum Length: 72 inches

- B. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.4 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.
- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.5 MANUAL GAS SHUTOFF VALVES

- A. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig.
 2. Threaded Ends: Comply with ASME B1.20.1.
 3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
 4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
 6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.
- B. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.
1. CWP Rating: 125 psig.
 2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
 3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 4. Service Mark: Initials "WOG" shall be permanently marked on valve body.
- C. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. A.Y. McDonald Mfg. Co.
 - b. Apollo Flow Controls; Conbraco Industries, Inc.
 - c. BrassCraft Manufacturing Co.; a Masco company.
 - d. Lyall, R. W. & Company, Inc.
 - e. Perfection Corporation.
 2. Body: Bronze, complying with ASTM B584.
 3. Ball: Chrome-plated bronze.
 4. Stem: Bronze; blowout proof.
 5. Seats: Reinforced TFE; blowout proof.
 6. Packing: Threaded-body packnut design with adjustable-stem packing.
 7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 8. CWP Rating: 600 psig.
 9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- D. Cast-Iron, Lubricated Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. A.Y. McDonald Mfg. Co.
 - b. Flowserve Corporation.
 - c. Homestead Valve.
 - d. Milliken Valve Company.
 - e. Mueller Co.
 - f. R & M Energy Systems; Robbins & Myers.
2. Body: Cast iron, complying with ASTM A126, Class B.
3. Plug: Bronze or nickel-plated cast iron.
4. Seat: Coated with thermoplastic.
5. Stem Seal: Compatible with natural gas.
6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. Operator: Square head or lug type with tamperproof feature where indicated.
8. Pressure Class: 125 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

2.6 EARTHQUAKE VALVES

A. Earthquake Valves, Maximum Operating Pressure of 5 psig: Comply with ASCE 25.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Vanguard Valves, Inc.
 - b. Or Equal.
2. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
3. Maximum Operating Pressure: 5 psig.
4. Cast-aluminum body with nickel-plated chrome steel internal parts.
5. Nitrile-rubber valve washer.
6. Sight windows for visual indication of valve position.
7. Threaded end connections complying with ASME B1.20.1.
8. Wall mounting bracket with bubble level indicator.

2.7 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.

2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.

B. Service Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Actaris.
 - b. American Meter Company.
 - c. Fisher Control Valves & Instruments; a brand of Emerson Process Management.
 - d. Invensys.
 - e. Itron Gas.
 - f. Richards Industries.
2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 100 psig.

2.8 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. A.Y. McDonald Mfg. Co.
 - b. Capitol Manufacturing Company.

- c. Central Plastics Company.
- d. HART Industrial Unions, LLC.
- e. Jomar Valve.
- f. Matco-Norca.
- g. WATTS.
- h. Wilkins.
- i. Zurn Industries, LLC.

2. Description:

- a. Standard: ASSE 1079.
- b. Pressure Rating: 125 psig minimum at 180 deg F.
- c. End Connections: Solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.
- B. Inspect natural-gas piping according to NFPA 54 to determine that natural-gas utilization devices are turned off in piping section affected.
- C. Comply with NFPA 54 requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 for installation and purging of natural-gas piping.
- B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.
 - 1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.
- C. Steel Piping with Protective Coating:
 - 1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.

- D. Install fittings for changes in direction and branch connections.
- E. Install pressure gage upstream and downstream from each service regulator. Pressure gages are specified in Section 230519 "Meters and Gages for HVAC Piping."

3.4 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.
- B. Install underground valves with valve boxes.
- C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
- D. Install earthquake valves aboveground outside buildings according to listing.

3.5 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
 - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 - 2. Cut threads full and clean using sharp dies.
 - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
 - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
 - 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints:
 - 1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
 - 2. Bevel plain ends of steel pipe.
 - 3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
- F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

- G. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

3.6 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Install hangers for steel piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- C. Support horizontal piping within 12 inches of each fitting.
- D. Support vertical runs of steel piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.7 CONNECTIONS

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- C. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.8 LABELING AND IDENTIFYING

- A. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for piping and valve identification.
- B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.9 PAINTING

- A. Comply with requirements in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" for painting interior and exterior natural-gas piping.
- B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

- 1. Alkyd System: MPI EXT 5.1D.

- a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - c. Topcoat: Exterior alkyd enamel (flat).
 - d. Color: Gray.
- C. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.10 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Test, inspect, and purge natural gas according to NFPA 54 and authorities having jurisdiction.
- C. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.11 OUTDOOR PIPING SCHEDULE

- A. Underground natural-gas piping shall be one of the following:
 - 1. Steel pipe with wrought-steel fittings and welded joints, or mechanical couplings. Coat pipe and fittings with protective coating for steel piping.
- B. Aboveground natural-gas piping shall be one of the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
 - 2. Steel pipe with wrought-steel fittings and welded joints.
- C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.12 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Valves for pipe sizes NPS 2 and smaller at service meter shall be one of the following:
 - 1. Two-piece, full -port, bronze ball valves with bronze trim.
- B. Valves for pipe sizes NPS 2-1/2 and larger at service meter shall be one of the following:
 - 1. Two-piece, full -port, bronze ball valves with bronze trim.
 - 2. Cast-iron, nonlubricated plug valve.

- C. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:
 - 1. Two-piece, full -port, bronze ball valves with bronze trim.
- D. Distribution piping valves for pipe sizes NPS 2-1/2 and larger shall be one of the following:
 - 1. Two-piece, full -port, bronze ball valves with bronze trim.
 - 2. Cast-iron, lubricated plug valve.
- E. Valves in branch piping for single appliance shall be one of the following:
 - 1. Two-piece, full -port, bronze ball valves with bronze trim.

END OF SECTION 231123

SECTION 232300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Refrigerant pipes and fittings.
 - 2. Refrigerant piping valves and specialties.
 - 3. Refrigerants.

1.3 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to 2010 ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.4 PRODUCT STORAGE AND HANDLING

- A. Store piping with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-410A:
 - 1. Suction Lines for Air-Conditioning Applications: 300 psig.
 - 2. Suction Lines for Heat-Pump Applications: 535 psig.
 - 3. Hot-Gas and Liquid Lines: 535 psig.

2.2 COPPER TUBE AND FITTINGS

- A. Copper Tube: ASTM B 280, Type ACR.
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.
- D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.
- E. Brazing Filler Metals: AWS A5.8/A5.8M.
- F. Flexible Connectors:
 - 1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
 - 2. End Connections: Socket ends.
 - 3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch- long assembly.
 - 4. Working Pressure Rating: Factory test at minimum 500 psig.
 - 5. Maximum Operating Temperature: 250 deg F.

2.3 REFRIGERANTS

- A. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arkema Inc.
 - b. DuPont Fluorochemicals Div.
 - c. Genetron Refrigerants; Honeywell International Inc.
 - d. Mexichem Fluor Inc.
 - e.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

- A. Suction Lines NPS 1-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.
- B. Hot-Gas and Liquid Lines: Copper, Type L, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
- C. Hot-Gas and Liquid Lines:

1. NPS 5/8 and Smaller: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
- D. Safety-Relief-Valve Discharge Piping: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
- E. Safety-Relief-Valve Discharge Piping:
 1. NPS 5/8 and Smaller: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping adjacent to machines to allow service and maintenance.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Refer to Section 230923 "Direct Digital Control (DDC) System for HVAC" and Section 230993.11 "Sequence of Operations for HVAC DDC" for solenoid valve controllers, control wiring, and sequence of operation.
- K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

- M. Slope refrigerant piping as follows:
1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
 2. Install horizontal suction lines with a uniform slope downward to compressor.
 3. Liquid lines may be installed level.
- N. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- O. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- P. Identify refrigerant piping and valves according to Section 230553 "Identification for HVAC Piping and Equipment."
- Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.3 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.
- D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
1. Use Type BCuP (copper-phosphorus) alloy for joining copper socket fittings with copper pipe.
 2. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze or steel.

- F. Threaded Joints: Thread steel pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and to restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry-seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12M/D10.12.

3.4 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements for seismic restraints in Section 230548 "Vibration and Seismic Controls for HVAC."
- B. Comply with Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hangers, supports, and anchor devices.
- C. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
 - 2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
 - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
 - 4. Spring hangers to support vertical runs.
 - 5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- D. Install hangers for copper tubing, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- E. Support horizontal piping within 12 inches of each fitting.
- F. Support vertical runs of copper tubing to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Comply with ASME B31.5, Chapter VI.
 - 2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.

3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in "Performance Requirements" Article.
 - a. Fill system with nitrogen to the required test pressure.
 - b. System shall maintain test pressure at the manifold gage throughout duration of test.
 - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
 - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.6 SYSTEM CHARGING

- A. Charge system using the following procedures:
 1. Install core in filter dryers after leak test but before evacuation.
 2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
 4. Charge system with a new filter-dryer core in charging line.

3.7 ADJUSTING

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
- B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.
- D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
 1. Open shutoff valves in condenser water circuit.
 2. Verify that compressor oil level is correct.
 3. Open compressor suction and discharge valves.
 4. Open refrigerant valves except bypass valves that are used for other purposes.
 5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

END OF SECTION 232300

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.
6. Seismic-restraint devices.

- B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of the following products:

1. Sealants and gaskets.
2. Seismic-restraint devices.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and with performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7. Seismically brace duct hangers and supports in accordance with
 - 1. Seismic Hazard Level (SHL): AA.
 - 2. Connection Level: 1.
- C. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.
- D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Startup."
- E. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
- F. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.

2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
 - 1. Construct ducts of galvanized sheet steel unless otherwise indicated.
- B. Transverse Joints: Fabricate joints in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.

2. For ducts with longest side 36 inches or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.
 3. Where specified for specific applications, all joints shall be welded.
- C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." All longitudinal seams shall be Pittsburgh lock seams unless otherwise specified for specific application.
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
1. Construct ducts of galvanized sheet steel unless otherwise indicated.
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ductmate Industries, Inc.
 - b. Elgen Manufacturing.
 - c. Linx Industries (formerly Lindab).
 - d. McGill AirFlow LLC.
 - e. MKT Metal Manufacturing.
 - f. Nordfab Ducting.
 - g. SEMCO LLC.
 - h. Set Duct Manufacturing.
 - i. Sheet Metal Connectors, Inc.
 - j. Spiral Manufacturing Co., Inc.
 - k. Stamped Fittings Inc.
 - l. Insert manufacturer's name.
- B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

- C. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- D. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
 - 2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
- E. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.4 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G60.
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.

2.5 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
 - 1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.

2. Tape Width: 3 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10 inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.

2.6 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.
- B. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

2.7 SEISMIC-RESTRAINT DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. B-line, an Eaton business.
 2. CADDY; a brand of nVent.
 3. Ductmate Industries, Inc.
 4. Elgen Manufacturing.
 5. Hilti, Inc.
 6. Kinetics Noise Control, Inc.
 7. Mason Industries, Inc.
 8. TOLCO.
 9. Unistrut; Part of Atkore International.
 10. Or Equal.
- B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
 1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- C. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.

- D. Restraint Cables: ASTM A 603, galvanized-steel cables with end connections made of galvanized-steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.
- E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.
- F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested in accordance with ASTM E 488/E 488M.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and coordination drawings.
- B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install ducts in maximum practical lengths with fewest possible joints.
- D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

- J. Install fire, combination fire/smoke, and smoke dampers where indicated on Drawings and as required by code, and by local authorities having jurisdiction. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers and specific installation requirements of the damper UL listing.
- K. Install heating coils, cooling coils, air filters, dampers, and all other duct-mounted accessories in air ducts where indicated on Drawings.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."
- M. Elbows: Use long-radius elbows wherever they fit.
 - 1. Fabricate 90-degree rectangular mitered elbows to include turning vanes.
 - 2. Fabricate 90-degree round elbows with a minimum of three segments for 12 inches and smaller and a minimum of five segments for 14 inches and larger.
- N. Branch Connections: Use lateral or conical branch connections.

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts at a minimum to the following seal classes in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 1. Where practical, install concrete inserts before placing concrete.
 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 SEISMIC-RESTRAINT-DEVICE INSTALLATION

- A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with ASCE/SEI 7.
 - 1. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 - 2. Brace a change of direction longer than 12 feet.
- B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. Install cable restraints on ducts that are suspended with vibration isolators.
- E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction.
- F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.
- G. Drilling for and Setting Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - 5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.6 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:
 - 1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
 - 2. Test the following systems:
 - a. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections, selected by Architect from sections installed, totaling no less than 25 percent of total installed duct area for each designated pressure class.
 - b. Supply Ducts with a Pressure Class of 2- Inch wg or Higher: Test representative duct sections totaling no less than 50 percent of total installed duct area for each designated pressure class.
 - c. Return/Relief Ducts with a Pressure Class of 2- Inch wg or Higher: Test representative duct sections totaling no less than 50 percent of total installed duct area for each designated pressure class.
 - d. Exhaust Ducts with a Pressure Class of 2- Inch wg or Higher: Test representative duct sections totaling no less than 50 percent of total installed duct area for each designated pressure class.
 - e. Outdoor-Air Ducts with a Pressure Class of 2- Inch wg or Higher: Test representative duct sections totaling no less than 50 percent of total installed duct area for each designated pressure class.
 - 3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
 - 4. Testing of each duct section is to be performed with access doors, coils, filters, dampers, and other duct-mounted devices in place as designed. No devices are to be removed or blanked off so as to reduce or prevent additional leakage.
 - 5. Test for leaks before applying external insulation.
 - 6. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
 - 7. Give seven days' advance notice for testing.
- C. Duct System Cleanliness Tests:
 - 1. Visually inspect duct system to ensure that no visible contaminants are present.

2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness in accordance with "Description of Method 3 - NADCA Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
 - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
- D. Duct system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.9 DUCT CLEANING

- A. Clean new duct system(s) before testing, adjusting, and balancing.
- B. For cleaning of existing ductwork, see Section 230130.52 "Existing HVAC Air Distribution System Cleaning."
- C. Use duct cleaning methodology as indicated in NADCA ACR.
- D. Use service openings for entry and inspection.
 1. Provide openings with access panels appropriate for duct static-pressure and leakage class at dampers, coils, and any other locations where required for inspection and cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
 2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
 3. Remove and reinstall ceiling to gain access during the cleaning process.
- E. Clean the following components by removing surface contaminants and deposits:
 1. Air outlets and inlets (registers, grilles, and diffusers).
 2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
 3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
 4. Coils and related components.
 5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
 6. Supply-air ducts, dampers, actuators, and turning vanes.
 7. Dedicated exhaust and ventilation components and makeup air systems.
- F. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans in accordance with NADCA ACR. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents in accordance with manufacturer's written instructions after removal of surface deposits and debris.

3.10 STARTUP

- A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.11 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
 1. Fabricate all ducts to achieve SMACNA pressure class, seal class, and leakage class as indicated below.
- B. Supply Ducts:
 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units :
 - a. Pressure Class: Positive 1- inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 4.
 2. Ducts Connected to Constant-Volume Air-Handling Units :
 - a. Pressure Class: Positive 2- inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 4.
 3. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive 2- inch wg.
 - b. Minimum SMACNA Seal Class: B.

- c. SMACNA Leakage Class for Rectangular: 4.

C. Return Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units :
 - a. Pressure Class: Positive or negative 2- inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 4.
2. Ducts Connected to Air-Handling Units :
 - a. Pressure Class: Positive or negative 2- inch wg.
 - b. SMACNA Leakage Class for Rectangular: 4.
 - c. SMACNA Leakage Class for Round and Flat Oval: [2] [4] [8] [16].
3. Ducts Connected to Equipment Not Listed above:
 - a. Pressure Class: Positive or negative 2- inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 4.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
 - a. Pressure Class: Negative 2- inch wg.
 - b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 4.
2. Ducts Connected to Air-Handling Units :
 - a. Pressure Class: Positive or negative 2- inch wg.
 - b. Minimum SMACNA Seal Class: B if negative pressure, and B if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 4.
3. Ducts Connected to Equipment Not Listed above:
 - a. Pressure Class: Positive or negative 2- inch wg.
 - b. Minimum SMACNA Seal Class: B if negative pressure; A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 4.

E. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.

F. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Velocity 1000 fpm or Lower:
 - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
 - 2) Mitered Type RE 4 without vanes.
 - b. Velocity 1000 to 1500 fpm:
 - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 - c. Velocity 1500 fpm or Higher:
 - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
 - 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.

- 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
- 4) Radius-to Diameter Ratio: 1.5.
- b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
- c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

G. Branch Configuration:

- 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: Conical spin in.
- 2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
 - a. Velocity 1000 fpm or Lower: 90-degree tap.
 - b. Velocity 1000 to 1500 fpm: Conical tap.
 - c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Backdraft and pressure relief dampers.
- 2. Barometric relief dampers.
- 3. Manual volume dampers.
- 4. Turning vanes.

- B. Related Requirements:

- 1. Section 233346 "Flexible Ducts" for insulated and non-insulated flexible ducts.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
 2. Exposed-Surface Finish: Mill phosphatized.
- B. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. American Warming and Ventilating; a Mestek Architectural Group company.
 2. Cesco Products; a division of MESTEK, Inc.
 3. Flex-Tek Group.
 4. Greenheck Fan Corporation.
 5. Lloyd Industries, Inc.
 6. Nailor Industries Inc.
 7. NCA Manufacturing, Inc.
 8. Pottorff.
 9. Ruskin Company.
 10. Vent Products Co., Inc.
- B. Description: Gravity balanced.
- C. Maximum Air Velocity: 2000 fpm.
- D. Maximum System Pressure: 1-inch wg.
- E. Frame: Hat-shaped, 0.094-inch- thick, galvanized sheet steel, with welded corners or mechanically attached and mounting flange.
- F. Blades: Multiple single-piece blades, center pivoted, maximum 6-inch width, 0.025-inch- thick, roll-formed aluminum with sealed edges.
- G. Blade Action: Parallel.
- H. Blade Seals: Neoprene, mechanically locked.
- I. Blade Axles:
1. Material: Galvanized steel .
 2. Diameter: 0.20 inch.
- J. Tie Bars and Brackets: Galvanized steel.
- K. Return Spring: Adjustable tension.
- L. Bearings: Steel ball or synthetic pivot bushings.

M. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.
3. Electric actuators.
4. Chain pulls.
5. Screen Mounting: Front mounted in sleeve.
 - a. Sleeve Thickness: 20 gage minimum.
 - b. Sleeve Length: 6 inches minimum.
6. Screen Material: Galvanized steel.
7. Screen Type: [Bird] [Insect].
8. 90-degree stops.

2.4 BAROMETRIC RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Warming and Ventilating; a Mestek Architectural Group company.
2. Cesco Products; a division of MESTEK, Inc.
3. Greenheck Fan Corporation.
4. Lloyd Industries, Inc.
5. Nailor Industries Inc.
6. NCA Manufacturing, Inc.
7. Pottorff.
8. Ruskin Company.
9. Vent Products Co., Inc.

B. Suitable for horizontal or vertical mounting.

C. Maximum Air Velocity: 2000 fpm.

D. Maximum System Pressure: 2-inch wg.

E. Frame: Hat-shaped, 0.094-inch- thick, galvanized sheet steel, with welded corners or mechanically attached and mounting flange.

F. Blades:

1. Multiple, 0.050-inch- thick aluminum sheet.
2. Maximum Width: 6 inches.
3. Action: Parallel.
4. Balance: Gravity.
5. Off-center pivoted.

G. Blade Seals: Neoprene.

- H. Blade Axles: Galvanized steel .
- I. Tie Bars and Brackets:
 - 1. Material: Galvanized steel.
 - 2. Rattle free with 90-degree stop.
- J. Return Spring: Adjustable tension.
- K. Bearings: Synthetic.
- L. Accessories:
 - 1. Flange on intake.
 - 2. Adjustment device to permit setting for varying differential static pressures.

2.5 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Aire Technologies.
 - b. American Warming and Ventilating; a Mestek Architectural Group company.
 - c. Flexmaster U.S.A., Inc.
 - d. Flex-Tek Group.
 - e. McGill AirFlow LLC.
 - f. Nailor Industries Inc.
 - g. Pottorff.
 - h. Ruskin Company.
 - i. Trox USA Inc.
 - j. Vent Products Co., Inc.
 - 2. Standard leakage rating, with linkage outside airstream.
 - 3. Suitable for horizontal or vertical applications.
 - 4. Frames:
 - a. Frame: Hat-shaped, 0.05-inch- thick stainless steel.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
 - 5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized -steel, 0.064 inch thick.

6. Blade Axles: Galvanized steel.
 7. Bearings:
 - a. Oil-impregnated stainless-steel sleeve.
 8. Tie Bars and Brackets: Galvanized steel.
- B. Jackshaft:
1. Size: 0.5-inch diameter.
 2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
 3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.
- C. Damper Hardware:
1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
 2. Include center hole to suit damper operating-rod size.
 3. Include elevated platform for insulated duct mounting.

2.6 TURNING VANES

- 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. Aero-Dyne Sound Control Co.
 2. CL WARD & Family Inc.
 3. Ductmate Industries, Inc.
 4. Duro Dyne Inc.
 5. Elgen Manufacturing.
 6. Hardcast, Inc.
 7. METALAIRE, Inc.
 8. SEMCO LLC.
 9. Ward Industries; a brand of Hart & Cooley, Inc.
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."
- D. Vane Construction: Single wall.

- E. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Compliance with ASHRAE/IESNA 90.1-2004 includes Section 6.4.3.3.3 - "Shutoff Damper Controls," restricts the use of backdraft dampers, and requires control dampers for certain applications. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 - 1. Install steel volume dampers in steel ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Connect diffusers or light troffer boots to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.
- H. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.
- I. Install duct test holes where required for testing and balancing purposes.
- J. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

END OF SECTION 233300

SECTION 233346 - FLEXIBLE DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Insulated flexible ducts.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- C. Comply with the Air Diffusion Council's "ADC Flexible Air Duct Test Code FD 72-R1."
- D. Comply with ASTM E 96/E 96M, "Test Methods for Water Vapor Transmission of Materials."

2.2 INSULATED FLEXIBLE DUCTS

- 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. Flexmaster U.S.A., Inc.
 2. JP Lamborn Co..
 3. McGill AirFlow LLC.
 4. Thermaflex; a Flex-Tek Group company.
 5. Ward Industries; a brand of Hart & Cooley, Inc.
- B. Insulated, Flexible Duct: UL 181, Class 1, two-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.
1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 2. Maximum Air Velocity: 4000 fpm.
 3. Temperature Range: Minus 10 to plus 160 deg F.
 4. Insulation R-Value: R4.2.

2.3 FLEXIBLE DUCT CONNECTORS

- A. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.
- B. Non-Clamp Connectors: Adhesive plus sheet metal screws.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install flexible ducts according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install in indoor applications only. Flexible ductwork should not be exposed to UV lighting.
- C. Connect terminal units to supply ducts directly or with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.
- D. Connect diffusers or light troffer boots to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.
- E. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.
- F. Install duct test holes where required for testing and balancing purposes.
- G. Installation:
1. Install ducts fully extended.
 2. Do not bend ducts across sharp corners.
 3. Bends of flexible ducting shall not exceed a minimum of one duct diameter.
 4. Avoid contact with metal fixtures, water lines, pipes, or conduits.

5. Install flexible ducts in a direct line, without sags, twists, or turns.

H. Supporting Flexible Ducts:

1. Suspend flexible ducts with bands 1-1/2 inches wide or wider and spaced a maximum of 48 inches apart. Maximum centerline sag between supports shall not exceed 1/2 inch per 12 inches.
2. Install extra supports at bends placed approximately one duct diameter from center line of the bend.
3. Ducts may rest on ceiling joists or truss supports. Spacing between supports shall not exceed the maximum spacing per manufacturer's written installation instructions.
4. Vertically installed ducts shall be stabilized by support straps at a maximum of 72 inches o.c.

END OF SECTION 233346

SECTION 233416 - CENTRIFUGAL HVAC FANS

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. Backward-inclined centrifugal fans, including airfoil and curved blade fans.

1.3 ACTION SUBMITTALS

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

- 1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes for fans.
 - 2. Rated capacities, operating characteristics, and furnished specialties and accessories.
 - 3. Certified fan performance curves with system operating conditions indicated.
 - 4. Certified fan sound-power ratings.
 - 5. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 6. Material thickness and finishes, including color charts.
 - 7. Dampers, including housings, linkages, and operators.

- B. Shop Drawings:

- 1. Include plans, elevations, sections, and attachment details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.

PART 2 - PRODUCTS

2.1 BACKWARD-INCLINED CENTRIFUGAL FANS

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

1. Acme Engineering & Manufacturing Corp.
2. Aerovent; a division of Twin City Fan Companies, Ltd.
3. Central Blower Company.
4. Chicago Blower Corporation.
5. Cincinnati Fan.
6. COMEFRI.
7. Loren Cook Company.
8. New York Blower Company (The).
9. Northern Blower, Inc.

B. Description:

1. Factory-fabricated, -assembled, -tested, and -finished, direct-driven centrifugal fans, consisting of housing, wheel, fan shaft, bearings, motor, drive assembly, and support structure. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations.
2. Factory-installed and -wired disconnect switch.

C. Housings:

1. Housing Material: Aluminum.
2. Spun inlet cone with flange.

D. Wheels:

1. Wheel Configuration: SWSI construction with a precision-spun curved inlet flange and a backplate fastened to shaft with setscrews. Wheels shall be statically and dynamically balanced, and nonoverloading.
2. Backward-Inclined Airfoil Blades:
 - a. Aerodynamic design.
 - b. Heavy backplate.
 - c. Hollow die-formed, airfoil-shaped blades continuously welded at tip flange and backplate.

E. Motor Enclosure: Totally enclosed, fan cooled .

F. Accessories:

1. Discharge Dampers: Assembly with opposed blades constructed of two plates formed around, and to, shaft, channel frame, and sealed ball bearings; with blades linked outside of airstream to single control lever of same material as housing.
2. Inlet Screens: Grid screen of same material as housing.

2.2 SOURCE QUALITY CONTROL

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

- B. AMCA Compliance: Fans shall comply with AMCA 11 and bear the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION OF CENTRIFUGAL HVAC FANS

- A. Install centrifugal fans level and plumb.
- B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.
- D. Equipment Mounting:
 - 1. Comply with requirements for vibration isolation and seismic-control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
- E. Install units with clearances for service and maintenance.
- F. Label fans according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 DUCTWORK AND PIPING CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."
- B. Install ducts adjacent to fans to allow service and maintenance.

3.3 ELECTRICAL CONNECTIONS

- A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
 - 1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
 - 2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.4 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."

3.5 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- C. Replace fan and motor pulleys as required to achieve design airflow.
- D. Lubricate bearings.

3.6 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain centrifugal fans.

END OF SECTION 233416

SECTION 233713.13 - AIR DIFFUSERS

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. Rectangular and square ceiling diffusers.
 - 2. Perforated diffusers.
 - 3. Linear bar diffusers.

- B. Related Requirements:

- 1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers.

1.3 ACTION SUBMITTALS

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

- 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - 2. Diffuser Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.1 RECTANGULAR AND SQUARE CEILING DIFFUSERS

- 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. A-J Manufacturing Co., Inc.
 - 2. Anemostat Products; a Mestek company.
 - 3. Carnes Company.
 - 4. Hart & Cooley Inc.

5. Krueger.
 6. METALAIRE, Inc.
 7. Nailor Industries Inc.
 8. Price Industries.
 9. Shoemaker Mfg. Co.
 10. Titus.
 11. Tuttle & Bailey.
- B. Material: Steel.
- C. Finish: Baked enamel, color selected by Architect.
- D. Face Size: 24 by 24 inches.
- E. Face Style: Four cone.
- F. Mounting: Surface T-bar.
- G. Pattern: Adjustable.
- H. Dampers: Radial opposed blade.
- I. Accessories:
1. Equalizing grid.
 2. Plaster ring.
 3. Safety chain.
 4. Wire guard.
 5. Sectorizing baffles.
 6. Operating rod extension.

2.2 PERFORATED DIFFUSERS

- 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. A-J Manufacturing Co., Inc.
 2. Anemostat Products; a Mestek company.
 3. Carnes Company.
 4. Hart & Cooley Inc.
 5. Kees, Inc.
 6. Krueger.
 7. METALAIRE, Inc.
 8. Nailor Industries Inc.
 9. Price Industries.
 10. Shoemaker Mfg. Co.
 11. Titus.
 12. Tuttle & Bailey.
 13. Warren Technology.

- B. Devices shall be specifically designed for variable-air-volume flows.
- C. Material: Steel backpan and pattern controllers, with [steel] [aluminum] face.
- D. Finish: Baked enamel, color selected by Architect.
- E. Face Size: 24 by 24 inches .
- F. Duct Inlet: Round or Square.
- G. Face Style: Flush.
- H. Mounting: Surface T-bar.
- I. Pattern Controller: None.
- J. Dampers: Opposed blade.
- K. Accessories:
 - 1. Equalizing grid.
 - 2. Plaster ring.
 - 3. Safety chain.
 - 4. Wire guard.
 - 5. Sectorizing baffles.
 - 6. Operating rod extension.

2.3 LINEAR BAR DIFFUSERS

- 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. Anemostat Products; a Mestek company.
 - 2. Carnes Company.
 - 3. Dayus Register & Grille Inc.
 - 4. Hart & Cooley Inc.
 - 5. Krueger.
 - 6. METALAIRE, Inc.
 - 7. Nailor Industries Inc.
 - 8. Price Industries.
 - 9. Raymon-Donco.
 - 10. Titus.
 - 11. Tuttle & Bailey.
- B. Material: Aluminum.
- C. Finish: Baked enamel, color selected by Architect.

- D. Wide Core Spacing Arrangement: 3/16-inch- thick blades spaced 1/2 inch apart; zero-degree deflection.
- E. Frame: 3/4 inch wide.
- F. Mounting: Countersunk screw.
- G. Damper Type: Adjustable opposed-blade assembly.
- H. Accessories: Alignment pins.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where diffusers are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install diffusers level and plumb.
- B. Install diffusers with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

- A. After installation, adjust diffusers to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.13

SECTION 233713.23 - AIR REGISTERS AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Adjustable blade face .
 - 2. Fixed face .
 - 3. Linear bar grilles.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where registers and grilles are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install registers and grilles level and plumb.
- B. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

- A. After installation, adjust registers and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.23

SECTION 237416.11 - PACKAGED, SMALL-CAPACITY, ROOFTOP AIR-CONDITIONING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes packaged, small-capacity, rooftop air-conditioning units (RTUs) with the following components:
 - 1. Casings.
 - 2. Fans, drives, and motors.
 - 3. Coils.
 - 4. Refrigerant circuit components.
 - 5. Air filtration.
 - 6. Gas furnaces.
 - 7. Dampers.
 - 8. Electrical power connections.
 - 9. Controls.
 - 10. Roof curbs.
 - 11. Accessories.

1.3 DEFINITIONS

- A. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, small-capacity, rooftop air-conditioning units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.

1.4 ACTION SUBMITTALS

- A. Product Data: For each RTU.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Include rated capacities, dimensions, required clearances, characteristics, and furnished specialties and accessories.
 - 3. Include unit dimensions and weight.
 - 4. Include cabinet material, metal thickness, finishes, insulation, and accessories.
 - 5. Fans:

- a. Include certified fan-performance curves with system operating conditions indicated.
 - b. Include certified fan-sound power ratings.
 - c. Include fan construction and accessories.
 - d. Include motor ratings, electrical characteristics, and motor accessories.
- 6. Include certified coil-performance ratings with system operating conditions indicated.
- 7. Include filters with performance characteristics.
- 8. Include gas furnaces with performance characteristics.
- 9. Include dampers, including housings, linkages, and operators.
- B. Shop Drawings: For each packaged, small-capacity, rooftop air-conditioning unit.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans and other details, or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.
- B. Sample Warranty: For manufacturer's warranty.
- C. Product Certificates: Submit certification that specified equipment will withstand wind forces identified in "Performance Requirements" Article and in Section 230548 "Vibration and Seismic Controls for HVAC."
- D. Source quality-control reports.
- E. System startup reports.
- F. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Filters: One set(s) of filters for each unit.

2. Gaskets: One set(s) for each access door.
3. Fan Belts: [One] <Insert number> set(s) for each belt-driven fan.

1.8 WARRANTY

- A. Warranty: Manufacturer agrees to repair or replace components of outdoor, semi-custom, air-handling unit that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 1 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of RTUs and components.
- C. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- D. ASHRAE 15 Compliance: For refrigeration system safety.
- E. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- F. UL Compliance: Comply with UL 1995.
- G. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design mounting and restraints for RTUs, including comprehensive engineering analysis.
 1. Design RTU supports to comply with wind and seismic performance requirements.
- H. Seismic Performance: RTUs, accessories, and components 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 when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 2. Component Importance Factor: 1.0.

2.2 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. Carrier Corporation; a unit of United Technologies Corp.
 2. Trane.
 3. YORK; a Johnson Controls company.

2.3 UNIT CASINGS

- A. General Fabrication Requirements for Casings: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.
- B. Double-Wall Construction:
1. Outside Casing Wall: Galvanized steel, minimum 18 gauge thick with manufacturer's standard finish corrosion-resistant coating Insert special coating, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.
 2. Inside Casing Wall: G90-coated galvanized steel, 0.034 inch 0.028 inch thick.
 3. Floor Plate: G90 galvanized steel Insert material, treadplate, minimum 18 gauge thick.
 4. Casing Insulation:
 - a. Materials: Injected polyurethane foam insulation.
 - b. Casing Panel R-Value: Minimum <Insert value>.
 - c. Insulation Thickness: 1 inch 2 inches.
 - d. Thermal Break: Provide continuity of insulation with no through-casing metal in casing walls, floors, or roof of unit.
- C. Static-Pressure Classifications:
1. For Unit Sections Upstream of Fans: Minus 2-inch wg 3-inch wg.
 2. For Unit Sections Downstream and Including Fans: 2-inch wg 3-inch wg 4-inch wg.
- D. Panels and Doors:
1. Panels:
 - a. Fabrication: Formed and reinforced with same materials and insulation thickness as casing.
 - b. Fasteners: Two or more camlock type for panel lift-out operation. Arrangement shall allow panels to be opened against air-pressure differential.
 - c. Gasket: Neoprene, applied around entire perimeters of panel frames.

- d. Size: Large enough to allow inspection and maintenance of air-handling unit's internal components.
 - 2. Access Doors:
 - a. Hinges: A minimum of two ball-bearing hinges or stainless steel piano hinge and two wedge-lever-type latches, operable from inside and outside. Arrange doors to be opened against air-pressure differential.
 - b. Gasket: Neoprene, applied around entire perimeters of panel frames.
 - c. Size: Large enough to allow inspection and maintenance of air-handling unit's internal components.
 - 3. Locations and Applications:
 - a. Fan Section: Inspection and access panels.
 - b. Damper Section: Inspection and access panels.
 - c. Filter Section: Inspection and access panels large enough to allow periodic removal and installation of filters.
- E. Condensate Drain Pans:
- 1. Location: Each type of cooling coil.
 - 2. Construction:
 - a. Single-wall, stainless steel sheet.
 - 3. Drain Connection:
 - a. Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
 - b. Minimum Connection Size: NPS 1.
 - 4. Slope: Minimum 0.125-in./ft. slope, to comply with ASHRAE 62.1, in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and from humidifiers and to direct water toward drain connection.
 - 5. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

2.4 FANS, DRIVES, AND MOTORS

- A. Fan and Drive Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum-rated fan speed and motor horsepower.
- B. Drives, Direct: Factory-mounted, direct drive.
- C. Drives, Belt: Factory-mounted, V-belt drive, with adjustable alignment and belt tensioning, and with 1.5 service factor based on fan motor.

- D. Condenser-Coil Fan: propeller, mounted on shaft of permanently lubricated ECM motors.
- E. Relief-Air Fan: Propeller, Forward curved, Backward inclined, shaft mounted on permanently lubricated motor.
- F. Motors:
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 2. Enclosure Type: Open, dripproof.
 - 3. Enclosure Materials: Cast iron.
 - 4. Efficiency: Premium efficient as defined in NEMA MG 1.
 - 5. NEMA Design: <Insert designation>.
 - 6. Motor Pulleys: Adjustable pitch for use with 5-hp motors and smaller; fixed pitch for use with motors larger than 5 hp. Select pulley size so pitch adjustment is at the middle of adjustment range at fan design conditions.
 - 7. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.

2.5 COILS

- A. General Requirements for Coils:
 - 1. Comply with AHRI 410.
 - 2. Fabricate coils section to allow for removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).
 - 3. Coils shall not act as structural component of unit.
- B. Outdoor-Air Refrigerant Coil:
 - 1. Tubes: Copper.
 - 2. Fins:
 - a. Material: Aluminum Copper.
 - b. Fin Spacing: Maximum 12 10 8 fins per inch.
 - 3. Fin and Tube Joints: Mechanical bond.
 - 4. Headers: Seamless-copper headers with brazed connections.
 - 5. Frames: Galvanized steel Stainless steel.
 - 6. Coatings: Corrosion-resistant coating.
 - 7. Ratings: Designed, tested, and rated according to ASHRAE 33 and AHRI 410.
 - a. Working Pressure: Minimum 300 psig.

2.6 REFRIGERANT CIRCUIT COMPONENTS

- A. Refrigeration Specialties:

1. Expansion valve with replaceable thermostatic element.
2. Refrigerant filter/dryer.
3. Manual-reset high-pressure safety switch.
4. Automatic-reset low-pressure safety switch.
5. Minimum off-time relay.
6. Automatic-reset compressor motor thermal overload.
7. Brass service valves installed in compressor suction and liquid lines.

2.7 AIR FILTRATION

- A. Particulate air filtration is specified in Section 234100 "Particulate Air Filtration."
- B. Panel Filters:
 1. Description: Flat, non-pleated Pleated factory-fabricated, self-supported, disposable air filters with holding frames.
 2. Filter Unit Class: UL 900.
 3. Media: Interlaced glass, synthetic or cotton fibers coated with nonflammable adhesive and antimicrobial coating.

2.8 GAS FURNACES

- A. Description: Factory assembled, piped, and wired; complying with ANSI Z21.47/CSA 2.3 and NFPA 54.
- B. CSA Approval: Designed and certified by and bearing label of CSA.
- C. Burners: Stainless steel.
 1. Fuel: Natural gas.
 2. Ignition: Electronically controlled electric spark or hot-surface igniter with flame sensor.
 3. Gas Control Valve: Modulating.
 4. Gas Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.
- D. Heat-Exchanger and Drain Pan: Stainless steel.
- E. Venting, Gravity: Gravity vented.
- F. Safety Controls:
 1. Gas Manifold: Safety switches and controls complying with ANSI standards FM Global.

2.9 DAMPERS

- A. Outdoor: Low-leakage, double-skin, airfoil-blade, galvanized-steel dampers with compressible jamb seals and extruded-vinyl blade edge seals in opposed -blade arrangement with zinc-plated steel operating rods rotating in sintered bronze or nylon bearings mounted in a single galvanized-steel frame, and with operating rods connected with a common linkage. Leakage rate shall not exceed 4 cfm/sq. ft. at 1-inch wg and 8 cfm/sq. ft. at 4-inch wg .

2.10 ELECTRICAL POWER CONNECTIONS

- A. RTU shall have a single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

2.11 CONTROLS

- A. Control equipment and sequence of operation are specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."

2.12 ROOF CURBS

- A. Roof curbs with vibration isolators and wind or seismic restraints are specified in Section 230548 "Vibration and Seismic Controls for HVAC."
- B. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.
 - 1. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
 - a. Materials: ASTM C1071, Type I or II.
 - b. Thickness: 1 inch 1-1/2 inches 2 inches.
 - 2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.
 - a. Liner Adhesive: Comply with ASTM C916, Type I.
 - b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
 - c. Liner materials applied in this location shall have airstream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
 - d. Liner Adhesive: Comply with ASTM C916, Type I.
- C. Curb Dimensions: Height of 14 inches.

2.13 ACCESSORIES

- A. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required.
- B. Low-ambient kit using variable-speed condenser fans for operation down to 35 deg F.
- C. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.
- D. Remote potentiometer to adjust minimum economizer damper position.
- E. Return-air bypass damper.
- F. Factory- or field-installed, demand-controlled ventilation.
- G. Safeties:
 - 1. Condensate overflow switch.
 - 2. Phase-loss protection.
 - 3. High pressure control.
 - 4. Gas furnace airflow-proving switch.
- H. Coil guards of painted, galvanized-steel wire.
- I. Hail guards of galvanized steel, painted to match casing.
- J. Door switches to disable heating or reset set point when open.
- K. Outdoor-air intake weather hood.

2.14 MATERIALS

- A. Steel:
 - 1. ASTM A36/A36M for carbon structural steel.
 - 2. ASTM A568/A568M for steel sheet.
- B. Galvanized Steel: ASTM A653/A653M.
- C. Aluminum: ASTM B209.

2.15 SOURCE QUALITY CONTROL

- A. AHRI Compliance:
 - 1. Comply with AHRI 210/240 for testing and rating energy efficiencies for RTUs.
 - 2. Comply with AHRI 270 for testing and rating sound performance for RTUs.

B. AMCA Compliance:

1. Comply with AMCA 11 and bear the AMCA-Certified Ratings Seal for air and sound performance according to AMCA 211 and AMCA 311.
2. Damper leakage tested according to AMCA 500-D.
3. Operating Limits: Classify according to AMCA 99.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of RTUs.
- B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.
- C. Examine roofs for suitable conditions where RTUs will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Roof Curb: Install on roof structure or concrete base, level and secure, according to AHRI Guideline B. Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Section 077200 "Roof Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts. Coordinate sizes and locations of roof curbs with actual equipment provided.
 1. Install normal-weight, 3000-psi, compressive strength (28-day) concrete mix inside roof curb, [4 inches] <Insert dimension> thick. Concrete, formwork, and reinforcement are specified with concrete.

3.3 PIPING CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to RTU, allow space for service and maintenance.
- C. Connect condensate drain pans using NPS 1-1/4, ASTM B88, Type M copper tubing. Extend to nearest equipment or roof drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.

- D. Gas Piping: Comply with applicable requirements in Section 231123 "Facility Natural-Gas Piping." Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.

3.4 DUCT CONNECTIONS

- A. Comply with duct installation requirements specified in other HVAC Sections. Drawings indicate general arrangement of ducts. The following are specific connection requirements:
 - 1. Install ducts to termination at top of roof curb.
 - 2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
 - 3. Connect supply ducts to RTUs with flexible duct connectors specified in Section 233300 "Air Duct Accessories."
 - 4. Install return-air duct continuously through roof structure.

3.5 ELECTRICAL CONNECTIONS

- A. Connect electrical wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
- D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
 - 1. Nameplate shall be laminated acrylic or melamine plastic signs as specified in Section 260100 "Electrical General Provisions" Article 18 Identification of Equipment.
 - 2. Locate nameplate where easily visible.

3.6 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."

3.7 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Tests and Inspections:
 - 1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
 - 2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. RTU will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.8 STARTUP SERVICE

- A. Perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Inspect for visible damage to unit casing.
 - 3. Inspect for visible damage to furnace combustion chamber.
 - 4. Inspect for visible damage to compressor, coils, and fans.
 - 5. Inspect internal insulation.
 - 6. Verify that labels are clearly visible.
 - 7. Verify that clearances have been provided for servicing.
 - 8. Verify that controls are connected and operable.
 - 9. Verify that filters are installed.
 - 10. Clean condenser coil and inspect for construction debris.
 - 11. Clean furnace flue and inspect for construction debris.
 - 12. Connect and purge gas line.
 - 13. Inspect operation of barometric relief dampers.
 - 14. Verify lubrication on fan and motor bearings.
 - 15. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
 - 16. Adjust fan belts to proper alignment and tension.
 - 17. Start unit according to manufacturer's written instructions.
 - a. Start refrigeration system.
 - b. Do not operate below recommended low-ambient temperature.
 - c. Complete startup sheets and attach copy with Contractor's startup report.
 - 18. Inspect and record performance of interlocks and protective devices; verify sequences.

19. Operate unit for an initial period as recommended or required by manufacturer.
20. Perform the following operations for both minimum and maximum firing. Adjust burner for peak efficiency:
 - a. Measure gas pressure on manifold.
 - b. Inspect operation of power vents.
 - c. Measure combustion-air temperature at inlet to combustion chamber.
 - d. Measure flue-gas temperature at furnace discharge.
 - e. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
 - f. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.
21. Calibrate thermostats.
22. Adjust and inspect high-temperature limits.
23. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
24. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F above return-air temperature:
 - a. Coil leaving-air, dry- and wet-bulb temperatures.
 - b. Coil entering-air, dry- and wet-bulb temperatures.
 - c. Outdoor-air, dry-bulb temperature.
 - d. Outdoor-air-coil, discharge-air, dry-bulb temperature.
25. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
26. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
 - a. Supply-air volume.
 - b. Return-air volume.
 - c. Relief-air volume.
 - d. Outdoor-air intake volume.
27. Simulate maximum cooling demand and inspect the following:
 - a. Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.
28. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:
 - a. High-temperature limit on gas-fired heat exchanger.
 - b. Low-temperature safety operation.
 - c. Filter high-pressure differential alarm.
 - d. Economizer to minimum outdoor-air changeover.
 - e. Relief-air fan operation.
 - f. Smoke and firestat alarms.

29. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

3.9 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.

3.10 CLEANING

- A. After completing system installation and testing, adjusting, and balancing RTUs and air-distribution systems, clean RTUs internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters.

3.11 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Tests and Inspections:
 1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
 2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. RTU will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.12 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain RTUs.

END OF SECTION 237416.11

SECTION 238126 - SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Wiring Diagrams: For power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and 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. Filters: One set(s) for each air-handling unit.
 - 2. Gaskets: One set(s) for each access door.
 - 3. Fan Belts: One set(s) for each air-handling unit fan.

1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE Compliance:
 - 1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."

1.7 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period:
 - a. For Compressor: One year(s) from date of Substantial Completion.
 - b. For Parts: One year(s) from date of Substantial Completion.
 - c. For Labor: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 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. Carrier Corporation; a unit of United Technologies Corp.
 - 2. Mitsubishi Electric & Electronics USA, Inc.
 - 3. Mitsubishi Electric Sales Canada Inc.
 - 4. Mitsubishi Heavy Industries America, Inc.

2.2 INDOOR UNITS (5 TONS OR LESS)

- A. Concealed Evaporator-Fan Components:

1. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.
2. Insulation: Faced, glass-fiber duct liner.
3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.
4. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.
5. Fan Motors:
 - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
 - c. Wiring Terminations: Connect motor to chassis wiring with plug connection.
6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
7. Filters: Permanent, cleanable.
8. Condensate Drain Pans:
 - a. Single-wall, galvanized -steel sheet.
 - b. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
 - 1) Minimum Connection Size: NPS 1.

B. Wall-Mounted, Evaporator-Fan Components:

1. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.
2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.
3. Fan: Direct drive, centrifugal.
4. Fan Motors:
 - a. Multitapped, multispeed with internal thermal protection and permanent lubrication.
 - b. Enclosure Type: Totally enclosed, fan cooled.
 - c. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
6. Condensate Drain Pans:
 - a. Single-wall, galvanized -steel sheet.
 - b. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on [one end] [both ends] of pan.

- 1) Minimum Connection Size: NPS 1.
7. Air Filtration Section:
- a. General Requirements for Air Filtration Section:
 - 1) Comply with NFPA 90A.
 - 2) Minimum MERV according to ASHRAE 52.2.
 - 3) Filter-Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.
 - b. Disposable Panel Filters:
 - 1) Factory-fabricated, viscous-coated, flat-panel type.
 - 2) Thickness: 1 inch.
 - 3) MERV according to ASHRAE 52.2: 5.

2.3 OUTDOOR UNITS (5 TONS OR LESS)

A. Air-Cooled, Compressor-Condenser Components:

1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
 - a. Compressor Type: Scroll.
 - b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
 - c. Refrigerant: R-410A.
 - d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.
3. Fan: Aluminum-propeller type, directly connected to motor.
4. Motor: Permanently lubricated, with integral thermal-overload protection.
5. Low Ambient Kit: Permits operation down to 45 deg F.
6. Mounting Base: Polyethylene.

2.4 ACCESSORIES

- A. Thermostat: Low voltage with subbase to control compressor and evaporator fan.
- B. Automatic-reset timer to prevent rapid cycling of compressor.

- C. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.
- D. Drain Hose: For condensate, condensate lift pump by unit manufacturer powered from unit.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units level and plumb.
- B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
- C. Install roof-mounted, compressor-condenser components on equipment supports specified in Section 077200 "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.
- D. Equipment Mounting:
 - 1. Install ground-mounted, compressor-condenser components on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
 - 2. Install ground-mounted, compressor-condenser components on polyethylene mounting base.
 - 3. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
 - 4. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."
- E. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.
- C. Duct Connections: Duct installation requirements are specified in Section 233113 "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Section 233300 "Air Duct Accessories."

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Prepare test and inspection reports.

3.4 STARTUP SERVICE

- A. Perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.

3.5 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 238126

SECTION 260100 - ELECTRICAL GENERAL PROVISIONS

ARTICLE 1 SUMMARY

- 1.1 This Division of the specification outlines the provisions of the contract work to be performed under this Division.
- 1.2 This Section applies to and forms a part of each section of specifications in Division 26 and all work performed under the electrical and communications contracts.
- 1.3 In addition, work in this Division is governed by the provisions of the bidding requirements, contract forms, general conditions and all sections under general requirements.
- 1.4 These specifications contain statements which may be more definitive or more restrictive than those contained in the General Conditions. Where these statements occur, they shall take precedence over the General Conditions.
- 1.5 Where the words 'provide' or 'provision' are used, it shall be definitely interpreted as 'furnishing and installing complete in operating condition'. Where the words 'as indicated' or 'as shown' are used, it shall mean as shown on contract drawings.
- 1.6 Where items are specified in the singular, this Division shall provide the quantity as shown on drawings plus any spares or extras mentioned on drawings or specifications. All specified and supplied equipment shall be new.

ARTICLE 2 CONTRACTOR QUALIFICATIONS

- 2.1 The Contractor shall have a current California C-10 Electrical Contractor's license and all individuals working on this project shall have passed the Department of Industrial Relations Division of apprenticeship Standards – "Electrician Certification Program."

ARTICLE 3 CODES, PERMITS AND FEES

- 3.1 Comply with all applicable laws, ordinances, rules, regulations, codes, or rulings of governmental units having jurisdiction as well as standards of NFPA and serving utility requirements.
- 3.2 Obtain permits, fees, inspections, meter and the like, associated with work in each section of this Division.
- 3.3 Installation procedures, methods and conditions shall comply with the latest requirements of the Federal Occupational Safety and Health Act (OSHA).

ARTICLE 4 EXAMINATION OF PREMISES

- 4.1 Examine the construction drawings and premises prior to bidding. No allowances will be made for not being knowledgeable of existing conditions.

ARTICLE 5 STANDARDS

- 5.1 The following standard publications of the latest editions enforced and supplements thereto shall form a part of these specifications. All electrical work must, as a minimum, be in accordance with these standards.
- 5.1.1 2019 California Electrical Code (CEC), Part 3 Title 24 CCR.
 - 5.1.2 National Fire Protection Association.
 - 5.1.3 Underwriters' Laboratories, Inc. (UL).
 - 5.1.4 Certified Ballast Manufacturers' Association (CBM).
 - 5.1.5 National Electrical Manufacturers' Association (NEMA).
 - 5.1.6 Institution of Electrical & Electronics Engineers (IEEE).
 - 5.1.7 American Society for Testing & Materials (ASTM).
 - 5.1.8 National Board of Fire Underwriters (NBFU).
 - 5.1.9 National Board of Standards (NBS).
 - 5.1.10 American National Standards Institute (ANSI).
 - 5.1.11 Insulated Power Cable Engineers Association (IPECS).
 - 5.1.12 Electrical Testing Laboratories (ETL).
 - 5.1.13 National Electrical Safety Code (NESC).
 - 5.1.14 2019 California Building Code (CBC), Part 2, Title 24 CCR.
 - 5.1.15 2019 California Fire Code (CFC), Part 9, Title 24, CCR.
 - 5.1.16 2016 NFPA 72 with California State Amendments
 - 5.1.17 National Electrical Testing Association (NETA), 2010 or most current

ARTICLE 6 DEFINITIONS

- 6.1 Concealed: Hidden from sight, as in trenches, chases, hollow construction, or above furred spaces, hung ceilings - acoustical or plastic type, or exposed to view only in tunnels, attics, shafts, crawl spaces, unfinished spaces, or other areas solely for maintenance and repair.
- 6.2 Exposed, Non-Concealed, Unfinished Space: A room or space that is ordinarily accessible only to building maintenance personnel, a room noted on the 'finish schedule' with exposed and unpainted construction for walls, floors, or ceilings or specifically mentioned as 'unfinished'.
- 6.3 Finish Space: Any space ordinarily visible, including exterior areas.

ARTICLE 7 WORK AND MATERIALS

- 7.1 Unless otherwise specified, all materials must be new and of the best quality. Materials previously incorporated into other projects, salvaged, or refurbished are not considered new. Perform all labor in a thorough and workmanlike manner.

- 7.2 All materials provided under the contract must bear the UL label where normally available. Note that this requirement may be repeated under equipment specifications. In general, such devices as will void the label should be provided in separate enclosures and wired to the labeled unit in proper manner.

ARTICLE 8 SHOP DRAWINGS AND SUBMITTALS

- 8.1 Submit shop drawings and all data in accordance with Division 1 of these specifications and as noted below for all equipment provided under this Division.
- 8.2 Shop drawings submittals demonstrate to the Architect that the Contractor understands the design concept. The Contractor demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods of material and equipment he intends to use. If deviations, discrepancies, or conflicts between submittals and specifications are discovered either prior to or after submittals are processed, notify the Architect immediately.
- 8.3 Manufacturer's data and dimension sheets shall be submitted giving all pertinent physical and engineering data including weights, cross sections and maintenance instructions. Standard items of equipment such as receptacles, switches, plates, etc., which are cataloged items, shall be listed by manufacturer.
- 8.4 Index all submittals and reference them to these specifications. All submittal items shall be assembled and submitted, one for each specification section. (Multiple specification sections may be grouped together in one common submittal binder, as long as each individual section is clearly identified.) Partial or incomplete submittal sections will not be reviewed.

ARTICLE 9 EQUIPMENT PURCHASES

- 9.1 Arrange for purchase and delivery of all materials and equipment within 20 days after approval of submittals. All materials and equipment must be ordered in ample quantities for delivery at the proper time. If items are not on the project in time to expedite completion, the Owner may purchase said equipment and materials and deduct the cost from the contract sum.
- 9.2 Provide all materials of similar class or service by one manufacturer.

ARTICLE 10 COOPERATIVE WORK

- 10.1 Correct without charge any work requiring alteration due to lack of proper supervision or failure to make proper provision in time. Correct without charge any damage to adjacent work caused by the alteration.
- 10.2 Cooperative work includes: General supervision and responsibility for proper location and size of work related to this Division, but provided under the other sections of these

specifications, and installation of sleeves, inserts, and anchor bolts for work under each section in this Division.

ARTICLE 11 VERIFICATION OF DIMENSIONS

- 11.1 Scaled and figured dimensions are approximate only. Before proceeding with work, carefully check and verify dimensions, etc., and be responsible for properly fitting equipment and materials together and to the structure in spaces provided.
- 11.2 Drawings are essentially diagrammatic, and many offsets, bends, pull boxes, special fittings, and exact locations are not indicated. Carefully study drawings and premises in order to determine best methods, exact location, routes, building obstructions, etc. and install apparatus and equipment in manner and locations to avoid obstructions, preserve headroom, keep openings and passageways clear, and maintain proper clearances.

ARTICLE 12 CUTTING AND PATCHING

- 12.1 All cutting, and patching shall be in accordance with Division 1 of these specifications and as noted below.
- 12.2 Cut existing work and patch as necessary to properly install new work. As the work progresses, leave necessary openings, holes, chases, etc., in their correct location. If the required openings, holes, chases, etc., are not in their correct locations, make the necessary corrections at no cost to the Owner. Avoid excessive cutting and do not cut structural members including wall framing without the consent of the Architect.

ARTICLE 13 CLOSING-IN OF UNINSPECTED WORK

- 13.1 Cover no work until inspected, tested, and approved by the Architect. Where work is covered before inspection and test, uncover it and when inspected, tested, and approved, restore all work to original proper condition at no additional cost to Owner.

ARTICLE 14 EXCAVATION AND BACKFILL

- 14.1 All excavation and backfill shall be in accordance with Division 1 of these specifications and as noted below.
- 14.2 Perform all necessary excavation, shoring, and backfilling required for the proper laying of all conduits inside the building and premises, and outside as may be necessary.
- 14.3 Excavate all trenches open cut, keep trench banks as nearly vertical as practicable, and sheet and brace trenches where required for stability and safety. Excavate trenches true to line and make bottoms no wider than necessary to provide ample work room. Grade trench bottoms accurately. Machine grade only to the top line of the conduits, doing the remainder by hand. Do not cut any trench near or under footings without first consulting the Architect. All trenches shall be done in accordance with OSHA standards and regulations.

- 14.4 Backfilling shall be done with each layer compacted before another layer is added. No stones or coarse lumps shall be laid directly on a conduit or conduits.
- 14.5 Trenches shall be filled with the specified material. Sod, if any, shall be removed in cut sections and replaced in same manners.
- 14.6 Provide pumps and drainage of all open trenches for purposes of installing electrical duct and wiring.
- 14.7 Perform all backfilling in accordance with the requirements of and under the direction of the Geotechnical Engineer.
- 14.8 Where new underground trenching is required on sites or in any area where existing underground utilities exist, the Contractor shall provide an independent professional utility locating service to locate exact vertical and horizontal locations of all existing utilities. Where existing utilities are found the Contractor shall hand dig those areas to avoid disruption. The Contractor shall be responsible for immediate repairs to existing underground utilities damaged during construction. The Contractor shall repair all existing asphalt, concrete and landscape surfaces damaged or removed during construction to match their original conditions. Where trenching extends through public streets or roadways, the Contractor shall notify underground service alert in addition to the independent locating service 48 hours before start of construction to determine location of existing utilities by calling (800) 422-4133.

ARTICLE 15 CONCRETE

- 15.1 Where used for structures to be provided under the contract such as bases, etc., concrete work, and associated reinforcing shall be as specified under Division 3 of these specifications.
- 15.2 See other sections for additional requirements for underground vaults, cable ducts, etc.

ARTICLE 16 ACCESSIBILITY

- 16.1 Install all control devices or other specialties requiring reading, adjustment, inspection, repairs, removal, or replacement conveniently and accessibly throughout the finished building.
- 16.2 All required access doors or panels in walls and ceilings are to be furnished and installed as part of the work under this Section. Refer to Division 1 of these specifications and as noted below.
- 16.3 Where located in fire rated assemblies, provide doors which match the rating of the assembly and are approved by the jurisdictional authority.
- 16.4 Refer to 'finish schedule' for types of walls and ceilings in each area and the architectural drawings for rated wall construction.

- 16.5 Coordinate work of the various sections to locate specialties requiring accessibility with others to avoid unnecessary duplication of access doors.

ARTICLE 17 FLASHING

- 17.1 Flash and counter flash all conduits penetrating roofing membrane as shown on Architectural drawings. All work shall be in accordance with Division 7 of these specifications.

ARTICLE 18 IDENTIFICATION OF EQUIPMENT

- 18.1 All electrical equipment shall be labeled, tagged, stamped, or otherwise identified in accordance with the following schedules:

18.1.1 General:

- 18.1.1.1 In general, the installed laminated nameplates as hereinafter called for shall also clearly indicate its use, areas served, circuit identification, voltage and any other useful data.
- 18.1.1.2 All auxiliary systems, including communications, shall be labeled to indicate function.

18.1.2 Lighting and Local Panelboards:

- 18.1.2.1 Panel identification shall be with white and black micarta nameplates. Letters shall be no less than 3/8" high.
- 18.1.2.2 Circuit directory shall be two column typewritten card set under glass or glass equivalent. Each circuit shall be identified by the room number and/or number of unit and other pertinent data as required.

18.1.3 Distribution Switchboards and Feeders Sections:

- 18.1.3.1 Identification shall be with 1" x 4" laminated white micarta nameplates with black lettering on each major component, each with name and/or number of unit and other pertinent data as required. Letters shall be no less than 3/8" high.
- 18.1.3.2 Circuit breakers and switches shall be identified by number and name with 3/8" x 1-1/2" laminated micarta nameplates with 3/16" high letters mounted adjacent to or on circuit breaker or switch.

18.1.4 Disconnect Switches, Motor Starters and Transformers:

- 18.1.4.1 Identification shall be with white micarta laminated labels and 3/8" high black lettering.

- 18.1.5 All communication system terminal boxes including T.V., telephone/intercom, security, fire alarm, clock, and computer networking shall be provided with white micarta laminated labels and 3/8" high black lettering.

ARTICLE 19 CONSTRUCTION FACILITIES

- 19.1 Furnish and maintain from the beginning to the completion all lawful and necessary guards, railings, fences, canopies, lights, warning signs, etc. Take all necessary precautions required by City, State Laws, and OSHA to avoid injury or damage to any persons and property.
- 19.2 Temporary power and lighting for construction purposes shall be provided under this Section. All work shall be in accordance with Division 1 of these specifications.

ARTICLE 20 GUARANTEE

- 20.1 Guarantee all material, equipment and workmanship for all sections under this Division in writing to be free from defect of material and workmanship for one year from date of final acceptance, as outlined in the general conditions. Replace without charge any material or equipment proven defective during this period. The guarantee shall include performance of equipment under all site conditions, conditions of load, installing any additional items of control and/or protective devices, as required.

ARTICLE 21 PATENTS

- 21.1 Refer to the General Conditions for Contractor's responsibilities regarding patents.

ARTICLE 22 PLUMBING (DIVISION 22) / HEATING, VENTILATING, AND AIR CONDITIONING (DIVISION 23) / ELECTRICAL – COORDINATION REQUIREMENTS

- 22.1 All electrical work performed for this project shall conform to the California Electrical Code, to Local Building Codes and in conformance with Division 22, 23, and 26 of these specifications, whether the work is provided under the "Plumbing", "Heating, Ventilating, and Air Conditioning", or the "Electrical" Division of these specifications. Where the Division 22 and/or Division 23 Contractor is required to provide electrical work, he shall arrange for the work to be done by a licensed Division 26 Contractor, using qualified electricians. The Division 22 and/or Division 23 Contractor shall be solely and completely responsible for the correct functioning of all equipment regardless of who provided the electrical work.
- 22.2 The work under Division 22 and/or Division 23 shall include the following:
- 22.2.1 All motors required by mechanical equipment.
- 22.2.2 All starters for mechanical equipment which are not provided under the electrical division as part of a motor control center or otherwise indicated on the electrical drawings.

- 22.2.3 All wiring interior to packaged equipment furnished as an integral part of the equipment.
- 22.2.4 All control **wiring and conduit** for mechanical control systems.
- 22.2.5 All control systems required by mechanical equipment.
- 22.3 The work under Division 26 shall include the following:
 - 22.3.1 All power wiring and conduit; and conduit only for EMS control conductors between each building and the main control panel.
 - 22.3.2 Electrical disconnects as shown on the electrical drawings.
 - 22.3.3 Starters forming part of a motor control center.
- 22.4 All power wiring and conduit to equipment furnished under Division 22 and/or Division 23 shall be provided under Division 26. Control wiring and conduit, whether line voltage or low voltage, shall be provided under the division which furnishes the equipment.
- 22.5 Power wiring shall be defined as all wiring between the panelboard switchboard overcurrent device, motor control center starter or switch, and the safety disconnect switch or control panel serving the equipment. Also, the power wiring between safety disconnect switch and the equipment line terminals.
- 22.6 Control wiring shall be defined as all wiring, either line voltage or low voltage, required for the control and interlocking of equipment, including but not limited to wiring to motor control stations, solenoid valves, pressure switches, limit switches, flow switches, thermostats, humidistats, safety devices, smoke detectors, and other components required for the proper operation of the equipment.
- 22.7 All motor starters which are not part of motor control centers and which are required for equipment furnished under this Division shall be furnished and installed by the Division furnishing the equipment and power wiring connected under Division 26. Motor starters and control devices in motor control centers shall be furnished and installed under Division 26.
- 22.8 Division 26 Contractor shall make all final connections of power wiring to equipment furnished under this Division.
- 22.9 Wiring diagrams complete with all connection details shall be furnished under each respective Section.
- 22.10 Motor starters supplied by Plumbing and/or Heating, Ventilating and Air Conditioning shall be fused combination type minimum NEMA Size 1, and conform to appropriate NEMA standards for the service required. Provide NEMA type 3R/12 gasketed enclosures in wet locations. Provide all starters with appropriately sized overload protection and heater strips provided in each phase, hand/off auto switches, a minimum

of 2 NO and NC auxiliary contacts as required, and an integral disconnecting means. For ½ horsepower motors and below, when control requirements do not dictate the use of a starter, a manual motor starter switch with overload protection in each phase may be provided. Acceptable manufacturers are Allen Bradley, General Electric, Square D, Furnas and Cutler Hammer.

ARTICLE 23 EQUIPMENT ROUGH-IN

- 23.1 Rough-in all equipment, fixtures, etc. as designed on the drawings and as specified herein. The drawings indicate only the approximate location of rough-ins. Mounting heights of all switches, receptacles, wall mounted fixtures and such equipment must be coordinated with the Architectural Designs. The Contractor shall obtain all rough-in information before progressing with any work for rough-in connections. Minor changes in the contract drawings shall be anticipated and provided for under this Division of the specifications to comply with rough-in requirements.

ARTICLE 24 OWNER FURNISHED AND OTHER EQUIPMENT

- 24.1 Rough-in and make final connections to all Owner furnished equipment shown on the drawings and specified, and all equipment furnished under other sections of the specifications.

ARTICLE 25 EQUIPMENT FINAL CONNECTIONS

- 25.1 Provide all final connections for the following:
- 25.1.1 All equipment furnished under this Division.
 - 25.1.2 Electrical equipment furnished under other sections of the specification.
 - 25.1.3 Owner furnished equipment as specified under this Division.

ARTICLE 26 INSERTS, ANCHORS, AND MOUNTING SLEEVES

- 26.1 Inserts and anchors must be:
- 26.1.1 Furnished and installed for support of work under this Division.
 - 26.1.2 Mounting of equipment that is of such size as to be free standing and that equipment which cannot conveniently be located on walls, such as motor starters, etc., shall be rigidly supported on a framework of galvanized steel angle of Unistrut or B-line systems with all unfinished edges painted.
 - 26.1.3 Furnish and install all sleeves as required for the installation of all work under all Sections of this Division and for all communication systems including any communication systems described in this Section which are bid to the General

Contractor. Sleeves through floors, roof, and walls shall be as described in "Conduit and Fittings" Section 26 05 33.

ARTICLE 27 SEISMIC ANCHORING

- 27.1 All switchgear and other free standing electrical equipment or enclosures shall be anchored to the floor and braced at the top of the equipment to the structure. Where details have not been provided on the drawings, anchorage shall comply with CBC Section 1616A.1.26. The Contractor shall submit drawings signed by the Contractors registered structural Engineer indicating method of compliance prior installation.
- 27.2 All sound systems, communication, signal or data networking equipment or enclosures shall be anchored to the structure. Where details have not been provided on the drawings, anchorage shall comply with CBC Section 1616A.1.26. The Contractor shall submit drawings signed by the Contractors registered Structural Engineer indicating method of compliance prior to installation.

ARTICLE 28 RUST PROOFING

- 28.1 Rust proofing must be applied to all ferrous metals and shall be in accordance with Division 5 specifications and as noted below.
 - 28.1.1 Hot-dipped galvanized shall be applied and after forming of angle-iron, bolts, anchors, etc.
 - 28.1.2 Hot-dipped galvanized coating shall be applied after fabrication for junction boxes and pull boxes cast in concrete.

ARTICLE 29 GENERAL WIRING

- 29.1 Where located adjacent in walls, outlet boxes shall not be placed back to back, nor shall extension rings be used in place of double boxes, all to limit sound transmission between rooms. Provide short horizontal nipple between adjacent outlet boxes, which shall have depth sufficient to maintain wall coverage in rear by masonry wall.
- 29.2 In those instances where outlet boxes, recessed terminal boxes, or recessed equipment enclosures are installed in a fire rated assembly, provide "Flamesafe FSD 1077" fire stopping pads or approved equal, over the outlet or box.
- 29.3 Complete rough-in requirements of all equipment to be wired under the contract are not indicated. Coordinate with respective trades furnishing equipment or with the Architect as the case may be for complete and accurate requirements to result in a neat, workmanlike installation.

ARTICLE 30 SEPARATE CONDUIT SYSTEMS

- 30.1 Each electrical and signal system shall be contained in a separate conduit system as shown on the drawings and as specified herein. This includes each power system, each

lighting system, each signal system of whatever nature, telephone, standby system, sound system, control system, fire alarm system, etc.

- 30.2 Further, each item of building equipment must have its own run of power wiring. Control wiring may be included in properly sized conduit for equipment feeders of #6 AWG and smaller, having separate conduit for larger sizes.

ARTICLE 31 CLEANUP

- 31.1 In addition to cleanup specified under other sections, thoroughly clean all parts of the equipment. Where exposed parts are to be painted, thoroughly clean off any spattered construction materials and remove all oil and grease spots. Wipe the surface carefully and scrape out all cracks and corners.
- 31.2 Use steel brushes on exposed metal work to carefully remove rust, etc., and leave smooth and clean.
- 31.3 During the progress of the work, keep the premises clean and free of debris.

ARTICLE 32 UTILITY SERVICES

- 32.1 The Division 26 Contractor shall contact the serving utility companies; notify the serving power, telephone and cable TV utilities of the following:
- 32.1.1 Name and address of Contractor.
- 32.1.2 Estimated times of construction start, completion and required service connections.
- 32.1.3 Project service voltage, phase load, and service size.
- 32.1.4 Provide to the Architect written verification from each utility company indicating their concurrence with the contract documents.
- 32.2 Contractor shall notify underground service alert 48 hours before start of construction to determine location of existing utilities by calling (800) 422-4133. All work shall be in accordance with the Division 1 Sections of these specifications.
- 32.3 All utility company requirements shall be complied with and approval shall be obtained from the utility company for service equipment. Such as, verification of a field test of the ground fault protection on the main service equipment, panic hardware and etc.

ARTICLE 33 PAINTING

- 33.1 Paint all unfinished metal as required in accordance with Division 1 of these specifications. (Galvanized and factory painted equipment shall be considered as having a sub-base finish.)

ARTICLE 34 GENERAL DEMOLITION REQUIREMENTS

- 34.1 Remove existing work and items which are required to be removed in such manner that minimum damage and disturbance is caused to adjacent and connection work scheduled to remain. Repair or replace existing work schedule.
- 34.2 Include preparation of existing areas to receive new materials and removal of materials and equipment to alter or repair the existing building as indicated and as specified.
- 34.3 Perform demolition exercising proper care to prevent injury to the public, workmen and adjoining property.
- 34.4 Perform the removal, cutting, drilling of existing work with extreme care and use small tools in order not to jeopardize the structural integrity of the building.
- 34.5 Rebuild to existing condition or better, existing work which has to be removed to allow the installation of new work as required.
- 34.6 Remove, protect and reinstall existing items as indicated. Replace materials scheduled for reuse which are damaged by the Contractor to the extent that they cannot be reused, with equal quality material, and installation.
- 34.7 Do not reuse in this project materials and items removed from existing site or building, except with specific written approval by the Architect in each case, unless such removed material or item is specifically indicated or specified to be reused.
- 34.8 Remove materials and equipment indicated to be salvaged for reinstallation and store to prevent damage and reinstall as the work progresses. Do not reuse in this project, other materials and equipment removed from existing site or building, except with specific written approval by the Architect in each case.
- 34.9 Patch areas requiring patching, including damage caused by removing, relocating or adding fixtures and equipment, damages caused by demolition at adjacent materials.
- 34.10 Do not stockpile debris in the existing building, without the approval of the Architect. Remove debris as it accumulates from removal operations to a legal disposal area.
- 34.11 Contractor to assume existing oil filled and dry transformers, oil switches, ballasts, lamps, wooden poles, cross arms, computers, computer monitors, and conductor insulation containing materials considered hazardous. Comply with local, state and federal regulations, laws, and ordinances concerning removal, handling and protection

against exposure or environmental pollution. Contractor shall be responsible for removal of the above hazardous materials where encountered. Include all costs for such removal as part of this contract.

- 34.12 All fluorescent, compact fluorescent, high intensity discharge, metal halide, mercury vapor, high and low-pressure sodium, and neon lamps are to be disposed of as required by the California Waste Rule Regulations as described in the California Code of Regulations, Title 22, Division 4.5 and Chapter 23.
- 34.13 **Communication System:** Where new communication systems, (including telephone, intercom, clock, security, fire alarm, data, multimedia, CATV or lighting controls) are installed to replace existing systems, unless where otherwise directed the existing systems shall remain fully operational until the new system has been installed and tested. Demolition of the existing systems shall include removal of all equipment and associated wiring and exposed conduits and providing new blank covers for all abandoned device locations.
- 34.14 **Salvage Power Equipment:** The Contractor shall carefully remove all existing switchboards, panelboards, transformers, and confirm in writing which items the Owner wishes to keep. These items shall be transported to the Owner's maintenance facilities by the Contractor. All remaining items shall be disposed of by the Contractor.
- 34.15 **Salvage Lighting Equipment:** The Contractor shall confirm in writing which items the Owner wishes to keep. These items shall be transported to the Owner's maintenance facilities by the Contractor. All remaining items shall be disposed of by the Contractor.
- 34.16 **Salvage Communication Equipment:** The Contractor shall carefully remove all communication devices (telephone, intercom, clock, security, fire alarm, data, multimedia, CATV or lighting controls) and box each type of devices separately. The Contractor shall deliver all items to the Owner's maintenance facility.

ARTICLE 35 PROJECT CLOSEOUT

- 35.1 Prior to completion of project, compile a complete equipment maintenance manual for all equipment supplied under sections of this Division in accordance with Division 1 of these specifications and as described below.
- 35.2 Equipment Lists and Maintenance Manuals:
 - 35.2.1 Prior to completion of job, Contractor shall compile a complete equipment list and maintenance manuals. The equipment list shall include the following items for every piece of material equipment supplied under this Section of the specifications:
 - 35.2.1.1 Name, model, and manufacturer.
 - 35.2.1.2 Complete parts drawings and lists.

- 35.2.1.3 Local supply for parts and replacement and telephone number.
- 35.2.1.4 All tags, inspection slips, instruction packages, etc., removed from equipment as shipped from the factory, properly identified as to the piece of equipment it was taken from.
- 35.3 Maintenance manuals shall be furnished for each applicable section of the specifications and shall be suitably bound with hard covers and shall include all available manufacturers' operating and maintenance instructions, together with "as-built" drawings to properly operate and maintain the equipment. The equipment lists and maintenance manuals shall be submitted in duplicate to the Architect for approval not less than 10 days prior to the completion of the job. The maintenance manuals shall also include the name, address, and phone numbers of all subcontractors involved in any of the work specified herein. Four copies of the maintenance manuals bound in single volumes shall be provided.

ARTICLE 36 RECORD DRAWINGS

- 36.1 The Division 26 Contractor shall maintain record drawings as specified in accordance with Division 1 of these specifications, and as noted below.
- 36.2 Drawings shall show locations of all concealed underground conduit runs, giving the number and size of conduit and wires. Underground ducts shall be shown with cross section elevations and shall be dimensioned in relation to permanent structures to indicate their exact location. Drawing changes shall not be identified only with referencing CORs and RFIs, the drawings shall reflect all of the actual additions or changes made. All as-built drawing information shall be prepared by the contractor in AutoCAD, updating the contract computer files as needed to reflect actual installed conditions for all site plans, lighting, power, communication, networking, audio visual, security or fire alarms systems included in the scope of work for this project.
- 36.3 One set of these record drawings shall be delivered to the Architect. The engineer will review documents for completeness and will not be responsible for editing contractor computer files.

ARTICLE 37 CHANGES AND EXTRA WORK

- 37.1 When **changes** in work are requested, the Division 26 Contractor shall provide unit prices for the work involved in accordance with Division 1 of these specifications, and the following:
 - 37.1.1 The material Costs shall **not exceed** the latest edition of the "Trade Service" end column "C" price list. The materials prices may be higher only where the Contractor can produce invoices to substantiate higher material costs. The Contractor shall submit a print out copy of the trade service sheets with the change order to substantiate these values.

- 37.1.2 The labor Costs shall **not exceed** the latest edition of the “NECA Manual of Labor Units” **normal column**.
- 37.2 When **credits** in work are requested, the Division 26 Contractor shall provide unit prices for the work involved in accordance with Division 1 of these specifications, and the following:
- 37.2.1 The Material Costs shall **not be less than 80% of** the latest edition of the “Trade Service” end column price list. The materials prices may be lower only where the Contractor can produce invoices to substantiate lower material costs. Restocking fees may also be included in this amount where applicable.
- 37.2.2 The Labor Costs shall **not be less than 80% of** the latest edition of the “NECA Manual of Labor Units” **normal column**.
- 37.3 Conduit pricing for conduits of all types sized 3" or smaller.
- When changes in the scope of work require the Contractor to estimate conduit Installations, they shall **NOT include labor values (only material cost may be included)** for any of the below items. The labor values for conduit installation represented in the NECA manual are inflated to a point where additional labor for the below items can not be justified.
- 37.3.1 Couplings.
- 37.3.2 Set Screw or Compression Fittings, locknuts, Bushings and washers.
- 37.3.3 Conduit straps and associated screws or nails.
- 37.3.4 LB fittings or other specialty fittings or specialty mounting hardware may be included where needed.
- 37.4 Wire pricing for all types and sizes.
- When changes in the scope of work require the Contractor to estimate wire installations they shall **NOT include labor values (only material cost may be included)** for any of the below items. The labor values for wire installation represented in the NECA manual are inflated to a point where additional labor for the below items can not be justified.
- 37.4.1 Locknuts, Bushings, tape, wire markers.
- 37.5 When changes in the scope of work require other equipment installations such as lighting fixtures, panelboards, switchboards, wiring devices, communications equipment etc. the Contractor shall **NOT include labor values (only material cost may be included)** for any of the below items. The labor values for these equipment items represented in the NECA manual are inflated to a point where additional labor for the below items can not be justified.

37.5.1 Associated screws, nails, bolts, anchors or supports.

37.5.2 Locknuts, washers, tape.

37.6 The total labor hours for extra work will be required to be calculated as follows:

37.6.1 Change orders with 1 to 30 total labor hours

General Laborer	10%	of total labor hours
Journeyman	10%	of total labor hours
Foreman	80%	of total labor hours

37.6.2 Change orders with 31 to 100 total labor hours

General Laborer	20%	of total labor hours
Journeyman	40%	of total labor hours
Foreman	40%	of total labor hours

37.6.3 Change orders with over 100 total labor hours

General Laborer	30%	of total labor hours
Journeyman	50%	of total labor hours
Foreman	20%	of total labor hours

37.7 When change orders are issued which allow the work to be completed in the normal sequence of construction, the labor rates shall be based on the most current “Prevailing Wage” – straight time total hourly rate. When change orders require the Contractor to work out of sequence the “Prevailing Wage” – daily overtime hourly rate shall apply. Special condition situations shall be reviewed on an individual basis for alternate hourly rate schedules.

37.8 Costs **will not** be permitted for additional supervision on site or office time for processing any change order other than the 10% overhead allowance as described in Division 1. Cost for special equipment required to install items for an individual change order are permitted and must be individually identified. Lump Sum cost for small tools or any other cost not specifically required for the change order are **not** permitted.

37.9 Contractor estimates shall be formatted to clearly identify each of the following:

37.9.1 Line item description of each type of material or labor item.

37.9.2 Description of quantity for each item.

37.9.3 Description of (material cost per / quantity).

37.9.4 Description of (labor cost per / quantity).

- 37.9.5 Description of total labor hour breakdown per Foreman, Journeyman or General Laborer as described above.

ARTICLE 38 ELECTRONIC FILES

- 38.1 The Contractor shall make a **written** request directly to Johnson Consulting Engineers for electronic drawing files. As a part of the written request, please include the following information:
- 38.1.1 Clearly indicate each drawing sheet needed (i.e., E1.1, E2.1, etc.).
- 38.1.2 Identify the name, phone number, mailing address and e-mail address of the person to receive the files.
- 38.1.3 Provide written confirmation and agreement with the requirements described for payment of computer files, as described below.
- 38.2 Detail or riser diagram sheets, or any other drawings other than floor plans or site plans, **will not be made available to the Contractor.**
- 38.3 Files will only be provided in the AutoCAD format in which they were created.
- 38.4 Requests for files will be processed as soon as possible; a minimum of 7 working days should be the normal processing time. The Contractor shall be completely responsible for requesting the files in time for their use.
- 38.5 CAD files will be made available via e-mail or on disk, depending on the quantity of files requested. The Contractor requesting the files will be required to pay \$50.00 per drawing plan, or \$300.00 maximum, whichever is **less**.

END OF SECTION 260100

SECTION 260519 - POWER CONDUCTORS

PART 1 – GENERAL

- 1.1 Furnish and install wire and cable for branch circuits and feeders specified herein and as shown on the electrical drawings.
- 1.2 Submittals: Submit manufacturers' data for the following items:
 - 1.2.1 All cables and terminations
- 1.3 **Common submittal mistakes which will result in the submittals being rejected:**
 - 1.3.1 Not including all items listed in the above itemized description.
 - 1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining, or clouding the items to be reviewed, or crossing out the items which are not applicable.
 - 1.3.3 Not including actual manufacturer's catalog information of proposed products.
 - 1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed

PART 2 – PRODUCTS

- 2.1 Wire and cable Rated 120 volt to 600 volt.
 - 2.1.1 All wire and cable shall be new, 600 volt insulated copper, of types specified below for each application. All wire and cable shall bear the UL label and shall be brought to the job in unbroken packages. Wire insulation shall be the color as specified herein and shall be type THWN-2. Insulated conductors shall be installed in all exterior exposed raceways. Conductors for branch circuit lighting, receptacle, power and miscellaneous systems shall be a minimum of No. 12 AWG. Increase conductor size to No. 10 AWG for 120 volt circuits greater than 100 feet from the panel to the load and for 277 volt circuits greater than 200 feet from the panel to the load. Circuit home-runs indicated to be larger than No. 12 must be increased the entire length of the circuit, including equipment grounding conductor. Wire sizes No. 14 through No. 10 shall be solid. No. 8 and larger shall be stranded.
 - 2.1.2 Aluminum conductors will be permitted (only where specifically identified on the drawings. See "600 Volt Feeder Schedule") in sizes 2/0 or larger. Conductors shall be listed by Underwriters Laboratories (UL) and suitable for operation at 600 volts or less, at a maximum operating temperature of 90N C maximum in wet or dry locations. Conductors shall be marked "SUN-RES". Aluminum alloy conductors shall be compact stranded conductors of

STABILOY® (AA-8030) as manufactured by Alcan Cable or Listed equal. AA-8000 Series aluminum alloy conductor material shall be recognized by The Aluminum Association.

2.1.3 MC type armored cable reference Section 26 05 33.

2.2 Wire and cable for systems below 120 volts.

2.2.1 All low voltage and communications systems cables routed underground shall be provided with a moisture resistant outer jacket, West Penn “Aquaseal” or equal, unless otherwise specified.

PART 3 - EXECUTION

3.1 Wire and cable shall be pulled into conduits without strain using powdered soapstone, mineralac, or other approved lubricant. In no case shall wire be repulled if same has been pulled out of a conduit run for any purpose. No conductor shall be pulled into conduit until conduit system is complete, including junction boxes, pull boxes, etc.

3.2 All connections of wires shall be made as noted below:

3.2.1 Connections to outlets and switches: Wire formed around binding post of screw.

3.2.2 No. 10 wire and smaller: Circuit wiring connections to lighting fixtures and other hardwired equipment shall be made with pressure type solderless connectors, Buchanan, Scotchlock, Wing Nut, or approved equal. Alternate “WAGO” #773 series or “IDEAL” #32, 33, 34 and 39 series push wire style connectors are also acceptable.

3.3 All wiring shall be continuous without splicing unless where specifically noted on the drawings or where permitted below.

3.3.1 No. 10 wire and smaller above grade: Quantities as needed, connection made with pressure type solderless connectors, Scotchlock or equal.

3.3.2 No. 10 wire and smaller below grade: Quantities as needed, connection made with ‘Raychem’ long barrel compression terminals with crimping tool and quantity of crimps as recommended by manufacturer, provide ‘Raychem’ WCSM-S series in-line heat shrink, sealant coated splice kit. Alternate products must be UL listed for direct burial/submersible and rated to (1000V).

3.3.3 No. 8 wire and larger above grade: Quantities only where indicated, ‘Raychem’ long barrel compression terminals with crimping tool and quantity of crimps as recommended by manufacturer, provide ‘Raychem’ WCSM-S series in-line heat shrink, sealant coated splice kit. Alternate products must be UL listed for direct burial/submersible and rated to (1000V).

3.3.4 No. 8 wire and larger below grade: Quantities only where indicated, ‘Raychem’ long barrel compression terminals with crimping tool and quantity of crimps as

recommended by manufacturer, provide 'Raychem' WCSM-S series in-line heat shrink, sealant coated splice kit. Alternate products must be UL listed for direct burial/submersible and rated to (1000V).

- 3.4 All wiring throughout shall be color coded as follows:

	<u>480 volt system</u>	<u>208 or 240 volt system</u>
A Phase	Brown	Black
B Phase	Orange	Red
C Phase	Yellow	Blue
Neutral	Grey	White
Ground	Green	Green

- 3.5 Wiring must be color coded throughout its entire length, except feeders may have color coded plastic tape at both ends and any other accessible point.
- 3.6 All control wiring in a circuit shall be color coded, each phase leg having a separate color, and with all segments of the control circuit, whether in apparatus or conduit, utilizing the same color coding.
- 3.7 At all terminations of control wiring, the wiring shall have a numbered T&B or Brady plastic wire marker.
- 3.8 Cables when installed are to be properly trained in junction boxes, etc., and in such a manner as to prevent any forces on the cable which might damage the cable.
- 3.9 All conductors to be installed into a common raceway, shall be pulled into the raceway at the same time.
- 3.10 All conductors shall be installed in such a manner as to not exceed the manufacturers' recommended pulling tension and bending radius. The equipment used for pulling must be specifically designed for the purpose. Motorized vehicles such as pickup trucks, are not acceptable.

END OF SECTION 260519

SECTION 260526 – GROUNDING

PART 1 – GENERAL

- 1.1 Furnish and install grounding and grounding conductors and electrodes as specified herein and as shown on the drawings.
- 1.2 Submit catalog data for all components.
- 1.3 **Common submittal mistakes which will result in the submittals being rejected:**
 - 1.3.1 Not including all items listed in the above itemized description.
 - 1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
 - 1.3.3 Not including actual manufacturer's catalog information of proposed products.
 - 1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

PART 2 – EXECUTION

- 2.1 Grounding
 - 2.1.1 All panelboard cabinets, equipment, enclosures, and complete conduit system shall be grounded securely in accordance with pertinent sections of CEC Article 250. Conductors shall be copper. All electrically operated equipment shall be bonded to the grounded conduit system. All non-current carrying conductive surfaces that are likely to become energized and subject to personal contact shall be grounded by one or more of the methods detailed in CEC Article 250. All ground connections shall have clean contact surfaces. Install all grounding conductors in conduit and make connections readily accessible for inspection.
 - 2.1.2 Provide an insulated equipment grounding conductor in all branch circuit and feeder raceway systems, sized in accordance with CEC 250-122.
 - 2.1.3 Provide an additional individual insulated grounding conductor for each circuit which contains an isolated ground receptacle or surge suppression receptacle.
 - 2.1.4 Grounding of metal raceways shall be assured by means of provisions of grounding bushings on feeder conduit terminations at the panelboard, and by means of insulated continuous stranded copper grounding wire extended from the ground bus in the panelboard to the conduit grounding bushings.

2.1.5 Except for connections which access for periodic testing is required, make grounding connections which are buried or otherwise inaccessible by exothermite type process.

2.1.6 The following ohmic values shall be test certified for each item listed. A written report signed and witnessed by the project IOR shall be provided to the engineer. If the ohmic value listed cannot be obtained additional grounding shall be installed to reach the value listed.

2.1.6.1 Service.10 ohms.

2.1.6.2 Step down transformers and non-current carrying metal parts
..... 25 ohms.

2.1.6.3 Manholes, handholes, etc.
..... 10 ohms.

END OF SECTION 260526

SECTION 260533 - CONDUIT AND FITTINGS

PART 1 – GENERAL

- 1.1 Furnish and install conduit and fittings as shown on the drawings and as specified herein.
- 1.2 Submit Manufacturer's data on the following:
 - 1.2.1 Conduit.
 - 1.2.2 Fittings
 - 1.2.3 Fire stopping Material.
 - 1.2.4 Surface Raceways.
 - 1.2.5 Type MC or MC-PCS cable, provide construction details and UL "E" number.
- 1.3 **Common submittal mistakes which will result in the submittals being rejected:**
 - 1.3.1 Not including all items listed in the above itemized description.
 - 1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
 - 1.3.3 Not including actual manufacturer's catalog information of proposed products.
 - 1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

PART 2 – PRODUCTS

- 2.1 Rigid steel conduit, intermediate metal conduit (IMC), electrical metallic tubing (EMT) and flexible metallic conduit shall be steel, hot dipped galvanized after fabrication.
- 2.2 PVC conduit shall be Carlon or approved equal.
- 2.3 Liquid tight flexible metal conduit shall be Anaconda Sealtite type UA or approved equal. Fittings shall be Appleton, Crouse-Hinds, Steel City, T&B, or equivalent.
- 2.4 MC type armored cable, when utilized, shall be provided with the following:
 - 2.4.1 Comply with UL 1479 and CEC 330
 - 2.4.2 90°C, copper, THHN conductors.

- 2.4.3 Minimum #12 insulated grounding conductor.
- 2.4.4 Conductors sized No. 10 and smaller shall be solid, No. 8 and larger shall be stranded.
- 2.4.5 Oversized (150%) neutrals or separate neutrals shall be provided.
- 2.4.6 Increase phase conductors to No. 10 AWG for 120 volt circuits greater than 100 feet from panel to load and for 277 volt circuits greater than 200 feet from panel to load. Where required increase conductor sizes for entire length of circuit.
- 2.4.7 Interlocked armored aluminum sheath.
- 2.4.8 AC or BX type armored cable shall not be substituted in lieu of MC type cable.
- 2.4.9 Color code cable according to cable type and configuration.
- 2.4.10 Acceptable manufacturers are AFC and Alflec.
- 2.5 MC-PCS luminary armored cable, when utilized, shall be provided with the following:
 - 2.5.1 Comply with UL 1479 and CEC 330
 - 2.5.2 90°C, copper, THHN conductors.
 - 2.5.3 Minimum #12 insulated grounding conductor.
 - 2.5.4 Lighting phase conductors sized No. 10 and smaller shall be solid, lighting control conductors shall be sized no. 16 solid.
 - 2.5.5 Interlocked armored aluminum sheath.
 - 2.5.6 AC or BX type armored cable shall not be substituted in lieu of MC type cable.
 - 2.5.7 Color code phase cable according to cable type and configuration. color code control conductors purple/gray.
 - 2.5.8 Acceptable manufacturers are AFC and Alflec.
- 2.6 Fire stopping material shall provide an effective seal against fire, heat, smoke and fire gases. Fire stopping material shall be tested to comply with ASTM E 814 and UL 1479. The submittal for this product shall include the UL listed system number and installation requirements for each type of penetration seal required for this project.
- 2.7 Each length of conduit shall be stamped with the name or trademark of the manufacturer and shall bear the UL label.

- 2.8 All plastic conduit shall be rigid, schedule 40, heavy wall PVC. All PVC conduit shall be UL listed. Underground utility company conduits shall comply with local utility co. requirements.
- 2.9 Plastic conduit shall be stored on a flat surface and protected from the direct rays of the sun.
- 2.10 Where branch circuit or communication raceways cannot be concealed in ceilings or walls and are required to be exposed in interior spaces, provide nonmetallic surface raceway system sized per the manufacturer capacity requirements. A full complement of nonmetallic fittings must be available and matching device boxes and cover plates must be provided. The color of the raceway system, components and boxes shall be (white). Where data networking cabling is to be installed, all raceway fittings shall meet Category 5 radius requirements. Where specific raceway types have been noted on the drawings they shall be as follows:

2.10.1	System 'SR'	Hubbell Wiremold Panduit Hellerman-Tyton	WALLTRAK 1 series ECLIPSE PN05series LD5 series TSR2 series
2.10.2	System 'SR2'	Hubbell Wiremold Panduit Hellerman-Tyton	WALTRAK 22 2300D Series D2P10 TSR3 series
2.10.3	System 'SR3'	Hubbell Wiremold Panduit Hellerman-Tyton	BASETRAK series 5400 - series 70 series MCR Infostream" series

Provide with offset boxes, inline boxes may only be used where specifically shown on the drawings.

PART 3 – FITTINGS

- 3.1 All metallic fittings, including those for EMT, flexible conduit, or malleable iron. Die cast fittings of any other material are not permitted.
- 3.2 Locknuts shall be steel or malleable iron with sharp clean cut threads.
- 3.3 Entrance seals shall be 0.Z. type FSK or equivalent.
- 3.4 Bushings and locknuts: Where conduits enter boxes, panels, cabinets, etc., they shall be rigidly clamped to the box by locknuts on the outside, and a lock nut and plastic bushing on the inside of the box. All conduits shall enter the box squarely.

- 3.5 Furnish and install insulated bushings as per CEC article No. 300 - 4 (F) on all conduits. The use of insulated bushings does not exclude the use of double locknuts to fasten conduit to the box.
- 3.6 Transition from plastic to steel conduits shall be with PVC female threaded adaptors.
- 3.7 Couplings and connectors for rigid steel or IMC conduit must be threaded, or compression type (set screw fittings are not permitted).
- 3.8 Couplings and connectors for EMT shall be compression, watertight. Set screw connectors are not acceptable, except for systems below 120 volts.
- 3.9 MC or MC-PCS type armored cable shall be provided with listed clamp type die cast zinc set screw connectors. Anti-short bushings shall be provided at all cable ends.
- 3.10 Connectors for flexible metal conduit shall be steel or malleable iron with screw provided to clinch the conduit into the adapter body. For sizes up to $\frac{3}{4}$ " a screw-in, "Jake type," fitting may be used.
- 3.11 Install approved expansion fittings, or liquid tight flex conduit with a minimum 6" slack for conduits passing through all expansion and seismic joints.

PART 4 - EXECUTION

- 4.1 All branch circuits shall be installed concealed in walls or above ceilings or in concrete floor slabs. PVC conduits installed in concrete floor slabs shall transition to PVC coated rigid steel where conduits penetrate above finished grade or finished floor.
- 4.2 Conduit sizes for various numbers and sizes of wire shall be as required by the CEC, but not smaller than $\frac{1}{2}$ " for power wiring and $\frac{3}{4}$ " for communications and fire alarm systems unless otherwise noted. Conduit in slab or below grade shall be $\frac{3}{4}$ " minimum trade size, unless otherwise identified.
- 4.3 Conduit size shall be such that the required number and sizes of wires can be easily pulled in and the Contractor shall be responsible for the selection of the conduit sizes to facilitate the ease of pulling. Conduit sizes shown on the drawings are minimum sizes in accordance with appropriate tables in the CEC. If because of bends or elbows a larger conduit size is required, the Contractor shall so furnish without further cost to the Owner.
- 4.4 The Contractor shall be entirely responsible for the proper protection of this work from the other trades on the job. When conduit becomes bent or holes are punched through same, or outlets moved after being roughed-in, the Contractor shall replace same, without additional cost to the Owner.
- 4.5 Rigid steel conduit or IMC shall be used as follows:
 - 4.5.1 Exposed exterior locations.

- 4.5.2 Exposed interior locations below eight feet above floor, except in electrical rooms and closets.
- 4.5.3 In hazardous or classified areas as required by CEC.
- 4.6 EMT conduit shall be used for areas as follows:
 - 4.6.1 All interior communications, signal, and data networking systems.
 - 4.6.2 All interior power wiring systems where not required to be in rigid steel, IMC or flexible conduit.
- 4.7 Flexible conduit shall be used for areas as follows:
 - 4.7.1 To connect motors, transformers, and other equipment subjected to vibration or where specifically detailed on the drawings.
 - 4.7.2 Flexible conduit shall not be used to replace EMT in other locations where the conduit will be exposed.
 - 4.7.3 Flexible metal conduit shall be ferrous. Installation shall be such that considerable slack is realized. The conduit shall contain separate code sized grounding conductor.
 - 4.7.4 Liquid tight flexible conduit shall be used in conformance with CEC in lengths not to exceed 4'. For equipment connections, route the conduit at 90 degrees to the adjacent path for point of connection. The conduit shall contain separate code sized grounding conductor. Use liquid tight flexible conduit for all equipment connections exposed in possible wet, corrosive or oil contaminated areas, e.g., shops and outside areas.
- 4.8 MC armored cable may be used as follows:
 - 4.8.1 All branch circuit wiring for lighting and power circuits where permitted and installed in compliance with UL 1569 and CEC 330.
- 4.9 MC-PCS luminary armored cable may be used as follows:
 - 4.9.1 All Lighting branch circuit wiring for lighting circuits where permitted and installed in compliance with UL 1569 and CEC 300-22(c), 330. This cable permits conductors of control circuits to be placed in a cable with lighting power circuits or class 1 circuits.
 - 4.9.2 It shall not be considered an acceptable option to install lighting control class 1 circuits as an open wire installation.
- 4.10 MC and MC-PCS armored cable shall **not** be used for the following areas:
 - 4.10.1 Any exterior, underground or buried in concrete circuits.

- 4.10.2 Any circuits feeding HVAC equipment or pumps or any circuit with 30 AMPs or greater overcurrent protection.
- 4.10.3 Any exposed interior locations except in electrical, communication or mechanical equipment rooms.
- 4.10.4 Any exposed interior damp/wet locations, kitchens, science classrooms, shop areas, or concealed in science classroom casework, unless provided with approved PVC jacket.
- 4.10.5 Any hazardous rated area.
- 4.11 Plastic conduit shall be used for all exterior underground, in slab, and below slab on grade conduit installations. Install bell ends at all conduit terminations in manholes and pull boxes. Where plastic conduit transitions from below grade to above grade, no plastic conduit shall extend above finished exterior grade, or above interior finished floor level.
- 4.12 Plastic conduit joints shall be made up in accordance with the manufacturer's recommendations for the particular conduit and coupling selected. Conduit joint couplings shall be made watertight. Plastic conduit joints shall be made up by brushing a plastic solvent cement on the inside of a plastic fitting and on the outside of the conduit ends. The conduit and fitting shall then be slipped together with a quick one-quarter turn twist to set the joint tightly.
- 4.13 All underground conduit depths shall be as detailed on the drawings or a minimum of 30" below finished grade (when not specifically detailed otherwise), for all exterior underground conduits. Where concrete slurry or concrete encasement is provided, include "Red" color dye in mixture.
- 4.14 All underground conduits for power systems (600v and higher), shall be concrete encased and a minimum of 48" below grade or as detailed on the drawings. Where concrete slurry or concrete encasement is provided, include "Red" color dye in mixture.
- 4.15 Conduit shall be continuous from outlet to outlet, cabinet or junction box, and shall be so arranged that wire may be pulled in with the minimum practical number of junction boxes.
- 4.16 All conduits shall be concealed wherever possible. All conduit runs may be exposed in mechanical equipment rooms, electrical equipment rooms, electrical closets, and in existing or unfinished spaces. No conduit shall be run exposed in finished areas without the specific approval of the Architect.
- 4.17 All raceways which are not buried or embedded in concrete shall be supported by straps, clamps, or hangers to provide a rigid installation. Exposed conduit shall be run in straight lines at right angles to or parallel with walls, beams, or columns. In no case shall conduit be supported or fastened to other pipes or installed to prevent the ready removal of other trades piping. Wire shall not be used to support conduit.

- 4.18 It shall be the responsibility of the Contractor to consult the other trades before installing conduit and boxes. Any conflict between the location of conduit and boxes, piping, duct work, or structural steel supports, shall be adjusted before installation. In general, large pipe mains, waste, drain, and steam lines shall be given priority.
- 4.19 Conduits above lay-in grid type ceilings shall be installed in such a manner that they do not interfere with the "lift-out" feature of the ceiling system. Conduit runs shall be installed to maintain the following minimum spacing wherever practical.
- 4.19.1 Water and waste piping not less than 3".
- 4.19.2 Steam and steam condensate lines not less than 12".
- 4.19.3 Radiation and reheat lines not less than 6".
- 4.20 Provide all necessary sleeves and chases required where conduits pass through floors or walls as part of the work of this section. Core drilling will only be permitted where approved by the Architect.
- 4.21 All empty conduits and surface mounted raceways shall be provided with a 1/4" polypropylene plastic pull cord and threaded plastic or metal plugs over the ends. Fasten plastic "Dymo" tape label to exposed spare conduit to identify "power" or "communication" system, and to where it goes.
- 4.22 The ends of all conduits shall be securely plugged, and all boxes temporarily covered to prevent foreign material from entering the conduits during construction. All conduit shall be thoroughly swabbed out with a dry swab to remove moisture and debris before conductors are drawn into place.
- 4.23 Bending: Changes in direction shall be made by bends in the conduit. These shall be made smooth and even without flattening the pipe or flaking the finish. Bends shall be of as long a radius as possible, and in no case smaller than CEC requirements.
- 4.23.1 For power conduits for conductors (600v and below), provide minimum 36" radius (vertical) and 72" radius (horizontal) bends.
- 4.23.2 For power conduits for conductors (greater than 600v), provide minimum 72" radius (vertical) and 72" radius (horizontal) bends.
- 4.24 Supports: Conduit shall be supported at intervals as required by the California Electrical Code. Where conduits are run individually, they shall be supported by approved conduit straps or beam clamps. Straps shall be secured by means of toggle bolts on hollow masonry, machine screws or bolts on metal surfaces, and wood screws on wood construction. **[No perforated straps or wire hangers of any kind will be permitted. Where individual conduits are routed, or above ceilings, they shall be supported by hanger rods and hangers.]** Conduits installed exposed in damp locations shall be provided with clamp backs under each conduit clamp, to prevent accumulation of moisture around the conduits.

- 4.25 Where a number of conduits are to be run exposed and parallel, one with another, they shall be grouped and supported by trapeze hangers. Hanger rods shall be fastened to structural steel members with suitable beam clamps or to concrete inserts set flush with surface. A reinforced rod shall be installed through the opening provided in the concrete inserts. Beam clamps shall be suitable for structural members and conditions. Rods shall be galvanized steel 3/8" diameter minimum. Each conduit shall be clamped to the trapeze hanger with conduit clamps.
- 4.26 All concrete inserts and pipe clamps shall be galvanized. All steel bolts, nuts, washers, and screws shall be galvanized, or cadmium plated. Individual hangers, trapeze hangers and rods shall be prime-coated.
- 4.27 Openings through fire rated floors/walls and/or smoke walls through which conduits pass shall be sealed by Fire stopping material to comply with Division 1 to seal off flame, heat, smoke and fire gases. Sleeves shall be provided for power or communication system cables which are not installed in conduits and shall be sealed inside and out to comply with manufacturers UL system design details. Where multiple conduits and/or cable tray systems pass thru fire-rated walls at one location, the Contractor shall submit copies of the manufacturers UL system design details proposed for use on this project. All Fire stopping material shall have an hourly fire-rating equal to or higher than the fire rating of the floor or wall through which the conduit, cables, or cable trays pass.
- 4.28 Provide cap or other sealing type fitting on all spare conduits. Conduits stubbed into buildings from underground where cable only extends to equipment, the conduit/cable end shall be sealed to prevent moisture from entering the room or space.
- 4.29 All conduits which are part of a paralleled feeder or branch circuit shall be installed underground.
- 4.30 All conduits which are required as a part of systems specified in Divisions 27 or 28, or any other low voltage communication systems, shall be furnished and installed by the Division 26 Contractor.
- 4.30.1 The Contractor shall coordinate all conduit requirements with each system supplier prior to bid to determine special conduit system requirements.
- 4.30.2 The Contractor shall provide a pull rope in all conduits for these systems.
- 4.30.3 The Contractor shall provide conduit sleeves for all open cable installations thru rated walls or block walls. Provide conduit from each building main termination cabinet or backboard to the nearest accessible ceiling for access into all electrical or communications rooms.
- 4.31 In addition to the above requirements, the following requirements shall apply to all data networking conduits:
- 4.31.1 Flexible metal conduit may only be used where required at building seismic and/or expansion joints.

- 4.31.2 All underground conduits shall be provided with minimum 24" radius elbows (vertical) and 60" (horizontal).
- 4.31.3 No length of conduit above grade shall be installed to exceed 150 feet between pull boxes, or points of connection, unless where specifically detailed on the drawings.
- 4.31.4 No length of conduit shall be installed to exceed two 90-degree bends between pull boxes, or points of connection, unless where specifically detailed on the drawings.
- 4.32 Where surface raceways are installed in interior spaces, the Contractor shall take care to route in straight lines at right angles to or parallel with walls, beams, or columns. All raceways and device boxes shall be securely screwed to the finish surface with zinc screw "Auger" anchors Stk #ZSA1K by Gray Bar Electric or equal. Tape adhesive application will not be permitted.
- 4.33 The Contractor who installs surface raceway systems shall provide and install complete with wire retention clips, one for every (8) vertical feet or (5) horizontal feet or portion thereof. This Contractor shall also provide each raceway channel with pull strings.
- 4.34 It shall be the responsibility of the Contractor installing the raceway to coordinate the installation of raceway device plates and inserts with the communications or data contractors.
- 4.35 MC or MC-PCS cable shall be cut using a specific metallic sheath armor stripping tool. The use of hacksaws, dikes or any other tools not specifically designed to remove the armor sheath will not be permitted.
- 4.36 MC or MC-PCS cables installed in attic spaces or above lay-in ceilings shall be installed to be protected from physical damage. The cable shall be mounted along the sides or bottom of joists, rafters or studs.
- 4.37 Support wires used for supporting ceilings, lighting fixtures or other equipment items shall **not** be used to support MC or MC-PCS cables. Conduits, duct work, piping or any other equipment shall not be used to support or mount MC cables.
- 4.38 MC or MC-PCS cable supports, fasteners and clips shall be designed specifically for use with MC cables. Standard conduit supports, fasteners and clips, nails or other items are not permitted for installing MC cables.

END OF SECTION 260533

SECTION 260534 - OUTLET AND JUNCTION BOXES

PART 1 – GENERAL

- 1.1 Furnish and install electrical wiring boxes as specified and as shown on the electrical drawings.
- 1.2 Submit manufacturer's data for all items.
- 1.3 **Common submittal mistakes which will result in the submittals being rejected:**
 - 1.3.1 Not including all items listed in the above itemized description.
 - 1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
 - 1.3.3 Not including actual manufacturer's catalog information of proposed products.
 - 1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

PART 2 – PRODUCTS

- 2.1 Boxes shall be as manufactured by Steel City, Appleton, Raco, or approved equal.
- 2.2 All boxes must conform to the provisions of Article 370 of the CEC. All boxes shall be of the proper size to accommodate the quantity of conductors enclosed in the box. Minimum box size shall be 4" square x 1-½" deep.
- 2.3 Boxes generally shall be hot dipped galvanized steel with knockouts. Boxes on exterior surfaces or in damp locations shall be corrosion resistant, cast ferrous alloy and shall have threaded hubs for rigid conduit and neoprene gaskets for their covers. Boxes shall be Appleton Type FS, Crouse-Hinds, or the approved equal. Conduit bodies shall be corrosion resistant, cast malleable iron. Conduit bodies shall have threaded hubs for rigid conduit and neoprene gaskets for their covers. Conduit bodies shall be Appleton Unilets, Crouse-Hinds, or the approved equal. Where recessed, boxes shall have square cut corners.
- 2.4 Deep boxes shall be used in wall covered by wainscot or paneling and in walls or glazed tile, brick, or other masonry which will not be covered with plaster. Through the wall type boxes shall not be used unless specifically called for. All boxes shall be nongangable. Boxes in concrete shall be of a type to allow the placing of conduit without displacing the reinforcing bars. All lighting fixture outlet boxes shall be equipped with the proper fittings to support and attach a light fixture.

- 2.5 All light, switch, receptacle, fire alarm devices and similar outlets shall be provided with approved boxes, suitable for their function. Back boxes shall be furnished and installed as required for the equipment and/or systems under this contract.
- 2.6 Pull and junction boxes shall be code gauge boxes with screw covers. Boxes shall be rigid under torsional and deflecting forces and shall be provided with angle from framing where required. Boxes shall be 4" square with a blank cover in unfinished areas and with a plaster ring and blank cover in finished areas. Covers for flush mounted oversize boxes shall extend $\frac{3}{4}$ " past boxes all around. Covers for 4" square boxes shall extend $\frac{1}{4}$ " past box all around.
- 2.7 All terminal cabinets and junction boxes or equipment back boxes which are required as a part of systems specified in Divisions 27 or 28, or any other low voltage communication systems, shall be furnished and installed by the Division 26 Contractor.
 - 2.7.1 The Division 26 Contractor shall coordinate all box requirements with each system supplier prior to bid to determine special cabinet or back box requirements. The Contractor shall also provide stainless steel blank cover plates for all low voltage systems installed for future equipment.
 - 2.7.2 The Contractor shall provide all plywood backboards indicated on walls or inside equipment enclosures. All backboards shall be a minimum of $\frac{3}{4}$ " thick fire rated type plywood.
 - 2.7.3 The Contractor shall coordinate exact rough in locations and requirements with each system supplier.
- 2.8 In addition to the above requirements, boxes for data networking wiring and equipment shall comply with the following:
 - 2.8.1 All boxes shall be a minimum of 4-11/16" square x 2-1/8" deep.
 - 2.8.2 Where pull boxes are required on individual conduits 1-1/4" or smaller, provide 4-11/16" square x 2-1/8" deep boxes. Where pull boxes are required on conduits larger than 1-1/4" for straight pull through, provide eight times the conduit trade size for box length. Where pull boxes are required on conduits larger than 1-1/4" for an angle or a U-pull through installation, provide a minimum distance of six times the conduit trade size between the entering and exiting conduit run for each cable.
- 2.9 Recessed boxes installed in fire rated floors/walls and /or smoke walls shall be sealed by Fire stopping material to comply with Division 1 to seal off flame, heat, smoke and fire gases. The Contractor shall submit copies of the manufacturers UL system design details proposed for use on this project. All Fire stopping material shall have an hourly fire-rating equal to or higher than the fire rating of the floor or wall through which the conduit, cables, or cable trays pass.

PART 3 – EXECUTION

- 3.1 Boxes shall be installed where required to pull cable or wire, but in finished areas only by approval of the Architect. Boxes shall be rigidly attached to the structure, independent of any conduit support. Boxes shall have their covers accessible. Covers shall be fastened to boxes with machine screws to ensure continuous contact all around. Covers for surface mounted boxes shall line up evenly with the edges of the boxes.
- 3.2 Outlets are only approximately located on the plans and great care must be used in the actual location of the outlets by consulting the various detailed drawings and specifications. Outlets shall be flush with finished wall or ceiling, boxes installed symmetrically on such trim or fixture. Refer to drawings for location and orientation of all outlet boxes.
- 3.3 Furnish and install all plaster rings as may be required. Plaster rings shall be installed on all boxes where the boxes are recessed. Plaster rings shall be of a depth to reach the finished surface. Where required, extension rings shall be installed so that the plaster ring is flush with the finished surface.
- 3.4 All cabinets and boxes shall be secured by means of toggle bolts on hollow masonry; expansion shields and machine screws or standard precast inserts on concrete or solid masonry; machine screws or bolts on metal surfaces and wood screws on wood construction. All wall and ceiling mounted outlet boxes shall be supported by bar supports extending from the studs or channels on either side of the box. Boxes mounted on drywall or plaster shall be secured to wall studs or adequate internal structure.
- 3.5 Boxes with unused punched-out openings shall have the openings filled with factory-made knockout seals.
- 3.6 Where standby power and normal power are to be located in the same outlet box or 480V in a switch box, install partition barriers to separate the various systems.
- 3.7 All device boxes and junction boxes for fire alarm system shall be painted red and shall be 4-11/16" square by 2-1/8" deep. No exceptions.

END OF SECTION 260534

SECTION 260543 - UNDERGROUND PULL BOXES AND MANHOLES

PART 1 – GENERAL

- 1.1 Furnish and install electrical underground pullboxes and manholes as specified and as shown on the electrical drawings.
- 1.2 Submit manufacturer's data for all items.
- 1.3 **Common submittal mistakes which will result in the submittals being rejected:**
 - 1.3.1 Not including all items listed in the above itemized description.
 - 1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
 - 1.3.3 Not including actual manufacturer's catalog information of proposed products.
 - 1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements or "to be determined later" statements. The products being submitted must be the products installed.

PART 2 – PRODUCTS

- 2.1 The concrete for pull boxes and manholes shall be class 5500 psi or as noted on the drawings. All pullboxes and manholes and covers located in parking lots, driveways, roads, or any other driveable areas shall be traffic rated.
- 2.2 Each manhole shall be provided with a fiberglass ladder and ground rod. Ground rods shall be copper or a copper-clad steel 3/4" diameter by 10-feet long. All non-current carrying metallic components shall be grounded to the ground rods with minimum #6 copper wire.
- 2.3 All underground pullboxes shall be provided with steel bolt down type covers. Bolts shall be bronze or brass. All communication or signal system pullboxes shall be sized to comply with CEC Article 314 unless where other sizes are specifically noted on the drawings.
- 2.4 All underground pullbox and manhole covers shall be provided with either "electrical" or "telephone" or "fire alarm" markings. The telephone marking shall be used to identify telephone, T.V., clock or any other types of communication systems.
- 2.5 All power and communication systems shall be provided with separate pullboxes or manholes. Fire alarm circuits shall also be provided with separate pullboxes from any other type of communication systems.

PART 3 – INSTALLATION

- 3.1 Shoring of the excavation shall be in accordance with all federal, state and local regulations.
- 3.2 Provide sealing material for the joints between sections per manufacturer's instructions.
- 3.3 The contractor shall make the top and access assembly or lid flush with surrounding areas where installed in driveable or normal walking areas.

END OF SECTION 260543

SECTION 260923 - DIGITAL LIGHTING CONTROL SYSTEM

PART 1 – GENERAL

- 1.1 Furnish and install automatic lighting controls as shown on the drawings and as specified herein Submit manufacturers' data on all items.
- 1.2 Equipment shall be UL listed, comply with those portions of CEC as applicable to electrical wiring work and comply with those portions of NEMA or UL pertaining to types of electrical equipment and enclosures. The equipment shall also be certified by the California Energy Commission.
- 1.3 The manufacturer of the lighting control equipment shall have been actively engaged in the manufacture of the types and capacities required for the application for at least three years. It is the sole responsibility of the Division 26 contractor to ensure that submittals of material meet the performance specifications contained herein.
- 1.4 All components and assemblies shall be factory pre-tested and burned-in as a system for 48 hours prior to shipping.
- 1.5 Control Intent – Control Intent includes, but is not limited to:
 - 1.5.1 Defaults and initial calibration settings for such items as time delay, sensitivity, fade rates, etc.
 - 1.5.2 Initial sensor and switching zones
 - 1.5.3 Initial time switch settings
 - 1.5.4 Task lighting and receptacle controls
 - 1.5.5 Emergency Lighting control (if applicable)
 - 1.5.6 Manufacturer shall submit a point-to-point line diagram of the system configuration including all devices and accessories required to complete the system.
 - 1.5.7 Manufacturer shall submit data sheets on the components and system submitted, with descriptions of hardware and software components.

SYSTEM DESCRIPTION & OPERATION

- 1.6 The Lighting Control and Automation system as defined under this section covers the following equipment:
 - 1.6.1 Digital Occupancy Sensors – Self-configuring, digitally addressable and calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications

- 1.6.2 Digital Switches – Self-configuring, digitally addressable pushbutton on/off, dimming, and scene switches with two-way active infrared (IR) communications
- 1.6.3 Handheld remotes for personal control – One-button dimming, two-button on/off, or five-button scene remotes provide control using infrared communications. Remote may be configured in the field to control selected loads or scenes without special tools
- 1.6.4 Digital Daylighting Sensors – Single-zone closed loop, multi-zone open loop and single-zone dual-loop daylighting sensors with two-way active infrared (IR) communications can provide switching, bi-level, tri-level or dimming control for daylight harvesting
- 1.6.5 Digital Room Controllers – Self-configuring, digitally addressable one, two or three relay plenum-rated controllers for on/off control. Selected models include 0-10 volt or line voltage forward phase control dimming outputs and integral current monitoring capabilities
- 1.6.6 Digital Plug-Load Controllers – Self-configuring, digitally addressable, single relay, plenum-rated application-specific controllers. Selected models include integral current monitoring capabilities
- 1.6.7 Configuration Tools – Handheld remote for room configuration and relay panel programming provides two way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away. Unit to have Organic LED display, simple pushbutton interface, and allow bi-directional communication of room variables and occupancy sensor settings. Computer software also customizes room settings
- 1.6.8 Digital Lighting Management (DLM) local network – Free topology, plug-in wiring system (Cat 5e) for power and data to room devices
- 1.6.9 Digital Lighting Management (DLM) segment network – Linear topology, BACnet MS/TP network (1.5 twisted pair, shielded,) to connect multiple DLM local networks for centralized control
- 1.6.10 Network Bridge – provides BACnet MS-TP-compliant digital networked communication between rooms, panels and the Segment Manager or building automation system (BAS) and automatically creates BACnet objects representative of connected devices.
- 1.6.11 Segment Manager – provides web browser-based user interface for system control, scheduling, power monitoring, room device parameter administration and reporting
- 1.6.12 Programming and Configuration software – Optional PC-native application capable of accessing DLM control parameters within a room, for the local network, via a USB adapter, or globally, for many segment networks simultaneously, via BACnet/IP communication

- 1.6.13 LMCP Digital Lighting Management Relay Panel – provides up to 8, 24, or 48 mechanically latching relays. Relays include a manual override and a single push-on connector for easy installation or removal from the panel. Panel accepts program changes from handheld configuration tool for date and time, location, holidays, event scheduling, button binding and group programming. Provides BACnet MS/TP-compliant digital networked communication between other lighting controls and/or building automation system (BAS)
- 1.6.14 Emergency Lighting Control Unit (ELCU) – allows a standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building

LIGHTING CONTROL APPLICATIONS

- 1.7 Unless relevant provisions of the applicable local Energy Codes are more stringent, provide a minimum application of lighting controls as follows:
 - 1.7.1 Space Control Requirements – Provide occupancy/vacancy sensors with Manual- or Partial-ON functionality in all spaces except toilet rooms, storerooms, library stacks, or other applications where hands-free operation is desirable and Automatic-ON occupancy sensors are more appropriate. Provide Manual-ON occupancy/vacancy sensors for any enclosed office, conference room, meeting room, open plan system and training room. For spaces with multiple occupants, or where line-of-sight may be obscured, provide ceiling- or corner-mounted sensors and Manual-ON switches.
 - 1.7.2 Bi-Level Lighting – Provide multi-level controls in all spaces except toilet rooms, storerooms, library stacks, or applications where variable dimming is used
 - 1.7.3 Task Lighting / Plug Loads – Provide automatic shut off of non-essential plug loads and task lighting in all spaces except toilet rooms and storerooms. Provide Automatic-ON of plug loads whenever spaces are occupied. For spaces with multiple occupants a single shut off consistent with the overhead lighting may be used for the area
 - 1.7.4 Daylit Areas – Provide daylight-responsive automatic control in all spaces (conditioned or unconditioned) where daylight contribution is available as defined by relevant local building energy code:
 - 1.7.4.1 All luminaires within code-defined daylight zones shall be controlled separately from luminaires outside of daylit zones
 - 1.7.4.2 Daytime setpoints for total ambient illumination (combined daylight and electric light) levels that initiate dimming shall be programmed in compliance with relevant local building energy codes
 - 1.7.4.3 Multiple-leveled switched daylight harvesting controls may be utilized for areas marked on drawings

- 1.7.4.4 Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to turn off electric lighting when daylight is at or above required lighting levels, only if system functions to turn lamps back on at dimmed level, rather than turning full-on prior to dimming.
- 1.7.5 Conference, meeting, training, auditoriums, and multipurpose rooms shall have controls that allow for independent control of each local control zone. Rooms larger than 300 square feet shall instead have at least four (4) pre-set lighting scenes unless otherwise specified. Occupancy / vacancy sensors shall be provided to extinguish all lighting in the space. Spaces with up to four moveable walls shall include controls that can be reconfigured when the room is partitioned.
- 1.8 Submit shop drawings and manufacturers' data for all components including:
 - 1.8.1 Manufacturer shall submit in bill-of-material form an itemized list of all materials supplied to meet the specification.
 - 1.8.2 Manufacturer shall submit dimensional drawings of lighting control panel(s).
 - 1.8.3 Manufacturer shall submit a point-to-point line diagram of the system configuration including all devices and accessories required to complete the system.
 - 1.8.4 Manufacturer shall submit data sheets on the components and system submitted, with descriptions of hardware and software components
 - 1.8.5 Composite wiring and/or schematic diagram of each control circuit as proposed to be installed
 - 1.8.6 Show exact location of all digital devices, including at minimum sensors, room controllers, and switches for each area on reflected ceiling plans. (Contractor must provide AutoCAD format reflected ceiling plans)
 - 1.8.7 Provide room/area details including products and sequence of operation for each room or area. Illustrate typical acceptable room/area connection topologies
 - 1.8.8 Network riser diagram including floor and building level details. Include network cable specification and end-of-line termination details, if required. Illustrate points of connection to integrated systems. Coordinate integration with mechanical and/or other trades

QUALITY ASSURANCE

- 1.9 Manufacturer: Minimum 10 years' experience in manufacture of lighting controls

PROJECT CONDITIONS

- 1.10 Do not install equipment until following conditions can be maintained in spaces to receive equipment:

1.10.1 Ambient temperature: 0° to 40° C (32° to 104° F)

1.10.2 Relative humidity: Maximum 90 percent, non-condensing.

WARRANTY

- 1.11 Provide a five year limited manufacturer's warranty on all room control devices and panels

MAINTENANCE

- 1.12 Spare Parts:

1.12.1 Provide 5% spares of each product to be used for this project. All unused items shall be boxed and delivered to the owner at the completion of the project.

PART 2 – PRODUCTS

- 2.1 Acceptable Manufacturers: **WattStopper, Digital Lighting Management (DLM) and nLight by Acuity.**

Substitutions:

- 2.2 Bidder's wishing to obtain approval on manufacturers other than those specified in these specifications or on the drawings shall comply with the following procedures:

2.2.1 All substitution requests shall be submitted to the Architect / Engineer no less than 10 business days prior to the project bid opening date. Approvals when accepted will be issued in the form of an addendum to the contract. No consideration for substitutions will be provided after the award of the contract.

2.2.2 The substitution request must include a statement indicating how the substituted product may impact the completion of the project.

2.2.3 The substitution request must include a statement indicating the difference in price (both list price and Contractor price) between the specified product and the substitution.

2.2.4 The substitution request must include a detailed analysis indicating any differences between the specified product and the substitution.

2.2.5 Catalog literature for both the specified and the substitution shall be provided along with contact information of the manufacturer for the substituted product.

- 2.3 The contractor shall pay the Engineer (at their current standard hourly rates) for the time spent reviewing substitutions. These costs will be included as an addendum to be issued

to all bidders to include in their proposals and must be paid to the Engineer within 60 days of award of the project.

DIGITAL LIGHTING CONTROLS

- 2.4 Furnish the Company's system which accommodates the square-footage coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors, switches, daylighting sensors and accessories which suit the lighting and electrical system parameters.

DIGITAL WALL SWITCH OCCUPANCY SENSORS

- 2.5 Wallbox mounted passive infrared PIR or dual technology (passive infrared and ultrasonic) digital occupancy sensor with 1 or 2 switch buttons
- 2.6 Digital Occupancy Sensors shall provide scrolling LCD display for digital calibration and electronic documentation. Features include the following:
 - 2.6.1 Digital calibration and pushbutton configuration for the following variables:
 - 2.6.1.1 Sensitivity – 0-100% in 10% increments
 - 2.6.1.2 Time delay – 1-30 minutes in 1-minute increments xx
 - 2.6.1.3 Test mode – Five second time delay
 - 2.6.1.4 Detection technology – PIR, Dual Technology activation and/or re-activation.
 - 2.6.1.5 Walk-through mode
 - 2.6.1.6 Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network
 - 2.6.2 Programmable control functionality including:
 - 2.6.2.1 Each sensor may be programmed to control specific loads within a local network
 - 2.6.2.2 Sensor shall be capable of activating one of 16 user-definable lighting scenes.

- 2.6.2.3 Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically during the configurable period of time (default 10 seconds) after turning off.
- 2.6.2.4 On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
 - 2.6.2.4.1 Ultrasonic and Passive Infrared
 - 2.6.2.4.2 Ultrasonic only
 - 2.6.2.4.3 Passive Infrared only
- 2.6.3 Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods
- 2.6.4 Two RJ-45 ports for connection to DLM local network
- 2.6.5 Two-way infrared (IR) transceiver to allow remote programming through handheld configuration tool and control by remote person controls.
- 2.6.6 Device Status LEDs including:
 - 2.6.6.1.1 PIR detection
 - 2.6.6.1.2 Ultrasonic detection
 - 2.6.6.1.3 Configuration mode
 - 2.6.6.1.4 Load binding
- 2.6.7 Assignment of occupancy sensor to a specific load within the room without wiring or special tools
- 2.6.8 Assignment of local buttons to specific loads within the room without wiring or special tools
- 2.6.9 Manual override of controlled loads
- 2.6.10 All digital parameter data programmed into an individual wall switch sensor shall be retained in non-volatile FLASH memory within the wall switch sensor itself. Memory shall have an expected life of no less than 10 years.
- 2.7 BACnet object information shall be available for the following objects:
 - 2.7.1 Detection state

- 2.7.2 Occupancy sensor time delay
- 2.7.3 Occupancy sensor sensitivity, PIR and Ultrasonic
- 2.7.4 Button state
- 2.7.5 Switch lock control
- 2.7.6 Switch lock status
- 2.8 Units shall not have any dip switches or potentiometers for field settings
- 2.9 Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required
- 2.10 Two-button wall switch occupancy sensors, when connected to a single relay dimming room controller, shall operate in the following sequence as a factory default:
 - 2.10.1 Left button
 - 2.10.1.1 Press and release – Turn load on
 - 2.10.1.2 Press and hold – Raise dimming load
 - 2.10.2 Right button
 - 2.10.2.1 Press and release – Turn off
 - 2.10.2.2 Press and hold – Lower diming load
- 2.11 Low voltage momentary pushbuttons shall include the following features:
 - 2.11.1 Load/Scene Status LED on each switch button with the following characteristics:
 - 2.11.1.1 Bi-level LED
 - 2.11.1.2 Dim locator level indicates power to switch
 - 2.11.1.3 Bright status level indicates that load or scene is active
 - 2.11.2 The following button attributes may be changed or selected using a wireless configuration tool:
 - 2.11.2.1 Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
 - 2.11.2.2 Individual button function may be configured to Toggle, On only or Off only.
 - 2.11.2.3 Individual scenes may be locked to prevent unauthorized change.

- 2.11.2.4 Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
- 2.11.2.5 Ramp rate may be adjusted for each dimmer switch.
- 2.11.2.6 Switch buttons may be bound to any load on a room controller and are not load type dependent; each button may be bound to multiple load
- 2.12 WattStopper part numbers: LMPW, LMDW. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening

DIGITAL WALL OR CELING MOUNTED OCCUPANCY SENSOR

- 2.13 Wall or ceiling mounted (to suit installation) passive infrared (PIR), ultrasonic or dual technology digital (passive infrared and ultrasonic) occupancy sensor
- 2.14 Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:
 - 2.14.1 Digital calibration and pushbutton configuration for the following variables:
 - 2.14.1.1 Sensitivity – 0-100% in 10% increments
 - 2.14.1.2 Time delay – 1-30 minutes in 1 minute increments
 - 2.14.1.3 Test mode – Five second time delay
 - 2.14.1.4 Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.
 - 2.14.1.5 Walk-through mode
 - 2.14.1.6 Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
 - 2.14.2 Programmable control functionality including:
 - 2.14.2.1 Each sensor may be programmed to control specific loads within a local network.
 - 2.14.2.2 Sensor shall be capable of activating one of 16 user-definable lighting scenes.
 - 2.14.2.3 Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically within a configurable period of time (default 10 seconds) after turning off

- 2.14.2.4 On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
 - 2.14.2.4.1 Ultrasonic and Passive Infrared
 - 2.14.2.4.2 Ultrasonic or Passive Infrared
 - 2.14.2.4.3 Ultrasonic only
 - 2.14.2.4.4 Passive Infrared only
- 2.14.3 Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
- 2.14.4 One or two RJ-45 port(s) for connection to DLM local network
- 2.14.5 Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls
- 2.14.6 Device Status LEDs, which may be disabled for selected applications, including:
 - 2.14.6.1PIR detection
 - 2.14.6.2Ultrasonic detection
 - 2.14.6.3Configuration mode
 - 2.14.6.4Load binding
- 2.14.7 Assignment of occupancy sensor to a specific load within the room without wiring or special tools
- 2.14.8 Manual override of controlled loads
- 2.14.9 All digital parameter data programmed into an individual occupancy sensor shall be retained in non-volatile FLASH memory within the sensor itself. Memory shall have an expected life of no less than 10 years
- 2.15 BACnet object information shall be available for the following objects:
 - 2.15.1 Detection state
 - 2.15.2 Occupancy sensor time delay
 - 2.15.3 Occupancy sensor sensitivity, PIR and Ultrasonic

- 2.16 Units shall not have any dip switches or potentiometers for field settings

- 2.17 Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.
- 2.18 WattStopper product numbers: LMPX, LMDX, LMPC, LMUC, LMDC

DIGITAL WALL SWITCHES

- 2.19 Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configurations. Wall switches shall include the following features:
 - 2.19.1 Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
 - 2.19.2 Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
 - 2.19.3 Configuration LED on each switch that blinks to indicate data transmission.
 - 2.19.4 Load/Scene Status LED on each switch button with the following characteristics:
 - 2.19.4.1 Bi-level LED
 - 2.19.4.2 Dim locator level indicates power to switch
 - 2.19.4.3 Bright status level indicates that load or scene is active
 - 2.19.5 Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps
 - 2.19.6 Programmable control functionality including
 - 2.19.6.1 Button priority may be configured to any BACnet priority level, from 1-16, corresponding to networked operation allowing local actions to utilize life safety priority.
 - 2.19.6.2 Scene patterns may be saved to any button other than dimming rockers. Once set, buttons may be digitally locked to prevent overwriting of the preset levels
 - 2.19.7 All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years
- 2.20 BACnet object information shall be available for the following objects:
 - 2.20.1 Button state

- 2.20.2 Switch lock control
- 2.20.3 Switch lock status
- 2.21 Two RJ-45 ports for connection to DLM local network
- 2.22 Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration shall be required to achieve multi-way switching
- 2.23 The following switch attributes may be changed or selected using a wireless configuration tool:
 - 2.23.1 Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa)
 - 2.23.2 Individual button function may be configured to Toggle, On only or Off only.
 - 2.23.3 Individual scenes may be locked to prevent unauthorized change.
 - 2.23.4 Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours
 - 2.23.5 Ramp rate may be adjusted for each dimmer switch.
 - 2.23.6 Switch buttons may be bound to any load on a room controller and are not load type dependent; each button may be bound to multiple loads
- 2.24 WattStopper product numbers: LMSW-101, LMSW-102, LMSW-103, LMSW-104, LMSW-105, LMSW-108, LMDM-101. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening

HANDHELD REMOTE CONTROLS

- 2.25 Battery-operated handheld devices in 1, 2 and 5 button configurations for remote switching or dimming control. Remote controls shall include the following features:
 - 2.25.1 Two-way infrared (IR) transceiver for line of sight communication with DLM local network within up to 30 feet
 - 2.25.2 LED on each button confirms button press
 - 2.25.3 Load buttons may be bound to any load on a room controller and are not load type dependent; each button may be bound to multiple loads
 - 2.25.4 Inactivity timeout to save battery life
- 2.26 A wall mount holster and mounting hardware shall be included with each remote control
- 2.27 WattStopper part numbers: LMRH-101, LMRH-102, LMRH-105

DIGITAL PARTITION CONTROLS

- 2.28 Partition controls shall enable manual or automatic coordination of lighting controls in flexible spaces with up to four moveable walls by reconfiguring the connected digital switches and occupancy sensors
- 2.29 Four-button low voltage pushbutton switch for manual control.
 - 2.29.1 Two-way infrared (IR) transceiver for use with configuration remote control.
 - 2.29.2 Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall
 - 2.29.3 Configuration LED on each switch that blinks to indicate data transmission.
 - 2.29.4 Each button represents one wall; Green button LED indicates status.
 - 2.29.5 Two RJ-45 ports for connection to DLM local network.
- 2.30 WattStopper part number: LMPS-104. Available in white, light almond, ivory, grey and black; compatible with wall plates with decorator opening
- 2.31 Contact closure interface for automatic control via input from limit switches on movable walls (by others).
 - 2.31.1 Operates on Class 2 power supplied by DLM local network.
 - 2.31.2 Includes 24VDC output and four input terminals for maintained third party contact closure inputs.
 - 2.31.2.1 Input max. sink/source current: 1-5Ma
 - 2.31.2.2 Logic input signal voltage High: >18VDC
 - 2.31.2.3 Logic input signal voltage Low: <2VDC
 - 2.31.3 Four status LEDs under hinged cover indicate if walls are open or closed; supports LMPS-104 as remote status indicator.
 - 2.31.4 Two RJ-45 ports for connection to DLM local network.
- 2.32 WattStopper part number: LMIO-102

DIGITAL DAYLIGHTING SENSORS

- 2.33 Digital daylighting sensors shall work with room controllers to provide automatic switching, bi-level, or tri-level or dimming daylight harvesting capabilities for any load type connected to a room controller. Daylighting sensors shall be interchangeable without the need for rewiring

- 2.33.1 Closed loop sensors measure the ambient light in the space and control a single lighting zone
- 2.33.2 Open loop sensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones
- 2.33.3 Dual loop sensors measure both ambient and incoming daylight in the space to insure that proper light levels are maintained as changes to reflective materials are made in a single zone
- 2.34 Digital daylighting sensors shall include the following features:
 - 2.34.1 The sensor's internal photodiode shall only measure lightwaves within the visible spectrum. The photodiode's spectral response curve shall closely match the entire photopic curve. The photodiode shall not measure energy in either the ultraviolet or infrared spectrums. The photocell shall have a sensitivity of less than 5% for any wavelengths less than 400 nanometers or greater than 700 nanometers
 - 2.34.2 Sensor light level range shall be from 1-6,553 footcandles (fc).
 - 2.34.3 The capability of ON/OFF, bi-level or tri-level switching, or dimming, for each controlled zone, depending on the selection of room controller(s) and load binding to room controller(s).
 - 2.34.4 For switching daylight harvesting, the photosensor shall provide a field-selectable deadband, or a separation, between the "ON Setpoint" and the "OFF Setpoint" that will prevent the lights from cycling excessively after they turn off.
 - 2.34.5 For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a field-selectable minimum level
 - 2.34.6 Photosensors shall have a digital, independently configurable fade rate for both increasing and decreasing light level in units of percent per second.
 - 2.34.7 Photosensors shall provide adjustable cut-off time. Cut-off time is defined by the number of selected minutes the load is at the minimum output before the load turns off. Selectable range between 0-240 minutes including option to never cut-off
 - 2.34.8 Optional wall switch override shall allow occupants to reduce lighting level to increase energy savings or, if permitted by system administrator, raise lighting levels for a selectable period of time or cycle of occupancy
 - 2.34.9 Integral infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls

2.34.10 Configuration LED status light on device that blinks to indicate data transmission

2.34.11 Status LED indicates test mode, override mode and load binding.

2.34.12 Recessed switch on device to turn controlled load(s) ON and OFF.

2.34.13 BACnet object information shall be available for the following daylighting sensor objects, based on the specific photocell's settings:

2.34.13.1 Day and night setpoints

2.34.13.2 Off time delay

2.34.13.3 On and off setpoints

2.34.13.4 Up top three setpoints

2.34.13.5 Operating mode – on/off, bi-level, tri-level or dimming

2.34.14 One RJ-45 port for connection to DLM local network

2.35 A choice of accessories to accommodate multiple mounting methods and building materials. The photosensors may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox. Standard tube photosensors accommodate mounting materials from 0-0.62" thickness (LMLS-400, LMLS-500). Extended tube photosensors accommodate mounting materials from 0.62"-1.25" thickness (LMLS-400-L, LMLS-500-L). Mounting brackets are compatible with J boxes (LMLS-MB1) and wall mounting (LMLS-MB2). LMLS-600 photosensor to be mounted on included bracket below skylight well

2.36 Any load or group of loads in the room can be assigned to a daylighting zone

2.37 Each load within a daylighting zone can be individually enabled or disabled for discrete control) load independence)

2.38 All digital parameter data programmed into a photosensor shall be retained in non-volatile FLASH memory within the photosensor itself. Memory shall have an expected life of no less than 10 years

Closed loop digital photosensors shall include the following additional features:

2.39 An internal photodiode that measures light in a 100-degree angle, cutting off the unwanted light from bright sources outside of this cone.

2.40 Automatic self-calibration, initiated from the photosensor, a wireless configuration tool or a PC with appropriate software

2.41 Automatically establishes application-specific setpoints following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of loads

2.42 WattStopper Product Number: LMLS-400, LMLS-400-L

Open loop digital photosensors shall include the following additional features:

2.43 An internal photodiode that measures light in a 60-degree angle cutting off the unwanted light from the interior of the room

2.44 Automatically establishes application-specific setpoints following manual calibration using a wireless configuration tool or a PC with appropriate software. For switching operation, an adequate deadband between the ON and OFF setpoints for each zone shall prevent the lights from cycling; for dimming operation, a proportional control algorithm shall maintain the design lighting level in each zone

2.45 Each of the three discrete daylight zones can include any non-overlapping group of loads in the room

2.46 WattStopper Product Number: LMLS-500, LMLS-500-L

Dual loop photosensors shall include the following additional features:

2.47 Close loop portion of dual loop device must have an internal photodiode that measures light in a 100 degree angle, cutting off the unwanted light from sources outside.

2.48 Open loop portion of dual loop device must have an internal photodiode that can measure light in a 60 degree angle, cutting off the unwanted light from the interior of the room

2.49 Automatically establishes application-specific set-points following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of load

2.50 Device must reference closed loop photosensor information as a base line reference. The device must be able to analyze the open loop photosensor information to determine if an adjustment in light levels is require

2.51 Device must be able to automatically commission setpoints each night to provide adjustments to electrical lighting based on changes in overall lighting in the space due to changes in reflectance within the space or changes to daylight contribution based on seasonal changes

2.52 Device must include extendable mounting arm to properly position sensor within a skylight well

2.53 WattStopper product number LMLS-600

DIGITAL ROOM CONTROLLERS AND PLUG – LOAD CONTROLLERS

- 2.54 Digital controllers for lighting and plug loads automatically bind the room loads to the connected devices in the space without commissioning or the use of any tools. Room and plug load controllers shall be provided to match the room lighting and plug load control requirements. The controllers will be simple to install, and will not have dip switches or potentiometers, or require special configuration for standard Plug n' Go applications. The control units will include the following features:
 - 2.54.1 Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room
 - 2.54.2 Simple replacement – Using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf
 - 2.54.3 Multiple room controllers connected together in a local network must automatically prioritize each room controller, without requiring any configuration or setup, so that loads are sequentially assigned using room controller device ID's from highest to lowest
 - 2.54.4 Device Status LEDs to indicate:
 - 2.54.4.1 Data transmission
 - 2.54.4.2 Device has power
 - 2.54.4.3 Status for each load
 - 2.54.4.4 Configuration status
 - 2.54.5 Quick installation features including:
 - 2.54.5.1 Standard junction box mounting
 - 2.54.5.2 Quick low voltage connections using standard RJ-45 patch cable
 - 2.54.6 Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power
 - 2.54.6.1 Turn on to 100%
 - 2.54.6.2 Remain off
 - 2.54.6.3 Turn on to last level
 - 2.54.7 Each load shall be configurable to operate in the following sequences based on occupancy:
 - 2.54.7.1 Auto-on/Auto-off (Follow on and off)

- 2.54.7.2 Manual-on/Auto-off (Follow off only)
- 2.54.8 The priority of each load output shall be reversible, via digital configuration, so that on is off and off is on
- 2.54.9 BACnet object information shall be available for the following objects:
 - 2.54.9.1 Load status
 - 2.54.9.2 Electrical current
 - 2.54.9.3 Total watts per controller
 - 2.54.9.4 Schedule state – normal or after-hours
 - 2.54.9.5 Demand response control and cap level
 - 2.54.9.6 Room occupancy status
 - 2.54.9.7 Total room lighting and plug loads watts
 - 2.54.9.8 Total room watts/sq ft
 - 2.54.9.9 Force on/off all loads
- 2.54.10 UL 2043 plenum rated
- 2.54.11 Manual override and LED indication for each load
- 2.54.12 Dual voltage (120/277 VAC, 60 Hz), or 347 VAC, 60 Hz (selected models only). 120/277 volt models rated for 20A total load, derating to 16A required for some dimmed loads (forward phase dimming); 347 volt models rated for 15A total load; plug load controllers carry application-specific UL 20 rating for receptacle control.
- 2.54.13 Zero cross circuitry each load
- 2.54.14 All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.
- 2.55 On/Off Controllers shall include:
 - 2.55.1 One or two relay configuration
 - 2.55.2 Efficient 150 mA switching power supply
 - 2.55.3 Three RJ-45 DLM local network ports with integral strain relief and dust cover
 - 2.55.4 WattStopper product numbers: LMRC-101, LMRC-102

- 2.56 On/Off/Dimming enhanced Room Controllers shall include:
 - 2.56.1 Real time current monitoring
 - 2.56.2 Multiple relay configurations
 - 2.56.2.1 One, two or three relays (LMRC-21 x series)
 - 2.56.2.2 One or two relays (LMRC-22x series)
 - 2.56.3 Efficient 250 mA switching power supply
 - 2.56.4 Four RJ-45 DLM local network ports with integral strain relief and dust cover
 - 2.56.5 Once dimming output per relay
 - 2.56.5.1 0-10V Dimming - Where indicated, one 0-10 volt analog output per relay for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting. (LMRC-21x series)
 - 2.56.5.2 Line Voltage, Forward Phase Dimming - Where indicated, one forward phase control line voltage dimming output per relay for control of compatible two-wire or three-wire ballasts, LED drivers, MLV, forward phase compatible ELV, neon/cold cathode and incandescent loads. (LMRC-22x series)
 - 2.56.5.3 Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected ballast or driver
 - 2.56.5.4 The LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim
 - 2.56.5.5 Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100% dimming range defined by the minimum and maximum calibration trim
 - 2.56.5.6 Calibration and trim levels must be set per output channel
 - 2.56.5.7 Devices that set calibration or trim levels per controller are not acceptable
 - 2.56.5.8 All configuration shall be digital. Devices that set calibration or trim levels per output channel via trim pots or dip-switches are not acceptable

- 2.56.6 Each load shall have an independently configurable preset on level for Normal Hours and After Hours events to allow different dimmed levels to be established at the start of both Normal Hours and After Hours events
- 2.56.7 Fade rates for dimming loads shall be specific to bound switch buttons, and the load shall maintain a default value for any bound buttons that do not specify a unique value
- 2.56.8 The following dimming attributes may be changed or selected using a wireless configuration tool:
 - 2.56.8.1 Establish preset level for each load from 0-100%
 - 2.56.8.2 Set high and low trim for each load
 - 2.56.8.3 Set lamp burn in time for each load up to 100 hours
- 2.56.9 Override button for each load provides the following functions:
 - 2.56.9.1 Press and release for on/off control
 - 2.56.9.2 Press and hold for dimming control
- 2.57 WattStopper product numbers: LMRC-211, LRMC-212, LMRC-221, LMRC-222
- 2.58 Plug Load Room Controllers shall include the following:
 - 2.58.1 One relay configuration with additional connection for unswitched load
 - 2.58.2 Configurable additive time delay to extend plug load time delay beyond occupancy sensor time delay (e.g. a 10 minute additive delay in a space with a 20 minute occupancy sensor delay ensures that plug loads turn off 30 minutes after the space is vacated)
 - 2.58.3 Factory default operation is Auto-on/Auto-off, based on occupancy
 - 2.58.4 Real time current monitoring of both switched and un-switched load (LMPL-201 only)
 - 2.58.5 Efficient switching power supply
 - 2.58.5.1 150mA (LMPL-101)
 - 2.58.5.2 250mA (LMPL-201)
 - 2.58.6 RJ-45 DLM local network ports
 - 2.58.6.1 Three RJ-45 ports (LMPL-101)
 - 2.58.6.2 Four RJ-45 ports (LMPL-201)

2.59 Wattstopper product numbers: LMPL-101, LMPL-201

DLM LOCAL NETWORK (Room Network)

2.60 The DLM local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building

2.61 Features of the DLM local network include:

2.61.1 Plug n' Go® automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached

2.61.2 Simple replacement of any device in the network with a standard off the shelf unit without requiring commissioning, configuration or setup

2.61.3 Push n' Learn® configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network

2.61.4 Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver

2.62 Digital room devices connect to the local network using pre-terminated Cat 5e cables with RJ-45 connectors, which provide both data and power to room devices. Systems that utilize RJ-45 patch cords but do not provide serial communication data from individual end devices are not acceptable

2.63 If manufacturer's pre-terminated Cat 5e cables are not used for the installation, the contractor is responsible for testing each cable following installation and supplying manufacturer with test results

2.64 WattStopper Product Number: LMRJ-Series

DLM SEGMENT NETWORK (Room to Room Network)

2.65 The segment network shall be a linear topology, BACnet-based MS/TP subnet to connect DLM local networks (rooms) and LMCP relay panels for centralized control

2.65.1 Each connected DLM local network shall include a single network bridge (LMBC-300), and the network bridge is the only room-based device that is connected to the segment network

2.65.2 Network bridges, relay panels and segment managers shall include terminal blocks, with provisions for separate "in" and "out" terminations, for segment network connections

- 2.65.3 The segment network shall utilize 1.5 twisted pair, shielded, cable supplied by the lighting control manufacturer. The maximum cable run for each segment is 4,000 feet. Conductor-to-conductor capacitance of the twisted pair shall be less than 30 pf/ft and have a characteristic impedance of 120 Ohms
- 2.65.4 Network signal integrity requires that each conductor and ground wire be correctly terminated at every connected device
- 2.65.5 Substitution of manufacturer-supplied cable must be pre-approved: Manufacturer will not certify network reliability, and reserves the right to void warranty, if non-approved cable is installed, and if terminations are not completed according to manufacturer's specific requirements
- 2.65.6 Segment networks shall be capable of connecting to BACnet-compliant BAS (provided by others) either directly, via MS/TP, or through NB-ROUTERS, via BACnet/IP or BACnet/Ethernet. Systems whose room-connected network infrastructure require gateway devices to provide BACnet data to a BAS are unacceptable

2.66 WattStopper Product Number: LM-MSTP, LM-MSTP-DB

CONFIGURATION TOOLS

- 2.67 A wireless configuration tool facilitates optional customization of DLM local networks using two-way infrared communications, while PC software connects to each local network via a USB interface
- 2.68 Features and functionality of the wireless configuration tool shall include but not be limited to:
 - 2.68.1 Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet
 - 2.68.2 High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation
 - 2.68.3 Must be able to read and modify parameters for room controllers, occupancy sensors, wall switches, daylighting sensors, network bridges and relay panels, and identify room devices by type and serial number
 - 2.68.4 Save up to eight occupancy sensor setting profiles, and apply profiles to selected sensors
 - 2.68.5 Temporarily adjust light level of any load(s) on the local network, and incorporate those levels in scene setting. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings

- 2.68.6 Adjust or fine-tune daylighting settings established during auto-configuration, and input light level data to complete configuration of open loop daylighting controls
- 2.68.7 Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings
- 2.68.8 Verify status of building level network devices
- 2.69 WattStopper Product Numbers: LMCT-100, LMCI-100/LMCS-100

NETWORK BRIDGE

- 2.70 The network bridge module connects a DLM local network to a BACnet-compliant segment network for communication between rooms, relay panels and a segment manager or BAS. Each local network shall include a network bridge component to provide a connection to the local network room devices. The network bridge shall use industry standard BACnet MS/TP network communication and an optically isolated EIA/TIA RS-485 transceiver
 - 2.70.1 The network bridge shall be provided as a separate module connected on the local network through an available RJ-45 port
 - 2.70.2 Provide Plug n' Go operation to automatically discover room devices connected to the local network and make all device parameters visible to the segment manager via the segment network. No commissioning shall be required for set up of the network bridge on the local network
 - 2.70.3 The network bridge shall automatically create standard BACnet objects for selected room device parameters to allow any BACnet-compliant BAS to include lighting control and power monitoring features as provided by the DLM room devices on each local network. BACnet objects will be created for the addition or replacement of any given in-room DLM device for the installed life of the system. Products requiring that an application-specific point database be loaded to create or map BACnet objects are not acceptable. Systems not capable of providing BACnet data for control devices via a dedicated BACnet Device ID and physical MS/TP termination per room are not acceptable. Standard BACnet objects shall be provided as follows:
 - 2.70.3.1 Read/write the normal or after hours schedule state for the room
 - 2.70.3.2 Read the detection state of each occupancy sensor
 - 2.70.3.3 Read the aggregate occupancy state of the room
 - 2.70.3.4 Read/write the On/Off state of loads
 - 2.70.3.5 Read/write the dimmed light level of loads

- 2.70.3.6 Read the button states of switches
- 2.70.3.7 Read total current in amps, and total power in watts through the room control
- 2.70.3.8 Read/write occupancy sensor time delay, PIR sensitivity and ultrasonic sensitivity settings
- 2.70.3.9 Activate a preset scene for the room
- 2.70.3.10 Read/write daylight sensor fade time and day and night setpoints
- 2.70.3.11 Read the current light level, in footcandles, from interior and exterior photosensors and photocells
- 2.70.3.12 Set daylight sensor operating mode
- 2.70.3.13 Read/write wall switch lock status
- 2.70.3.14 Read watts per square foot for the entire controlled room
- 2.70.3.15 Write maximum light level per load for demand response mode
- 2.70.3.16 Read/write activation of demand response mode for the room
- 2.70.3.17 Activate/restore demand response mode for the room

2.71 Wattstopper product number: LMBC-300

SEGMENT MANAGER

- 2.72 For networked applications, the Digital Lighting Management system shall include at least one segment manager to manage network communication. It shall be capable of serving up a graphical user interface via a standard web browser utilizing either unencrypted TCP/IP traffic via a configurable port (default is 80) or 256 bit AES encrypted SSL TCP/IP traffic via a configurable port (default is 443)
- 2.73 Each segment manager shall have integral support for at least three segment networks. Segment networks may alternately be connected to the segment manger via external routers and switches, using standard Ethernet structured wiring. Each router shall accommodate one segment network. Provide the quantity of routers and switches as shown on the plans
- 2.74 Operational features of the Segment Manager shall include the following:
 - 2.74.1 Connection to PC or LAN via standard Ethernet TCP/IP via standard Ethernet TCP/IP with the option to use SSL encrypted connections for all traffic

- 2.74.2 Easy to learn and use graphical user interface, compatible with Internet Explorer 8, or equal browser. Shall not require installation of any lighting control software to an end-user PC
- 2.74.3 Log in security capable of restricting some users to view-only or other limited operations
- 2.74.4 Automatic discovery of DLM devices and relay panels on the segment network(s). Commissioning beyond activation of the discovery function shall not be required to provide communication, monitoring or control of all local networks and lighting control panels
- 2.74.5 After discovery, all rooms and panels shall be presented in a standard navigation tree format. Selecting a device from the tree will allow the device settings and operational parameters to be viewed and changed by the use
- 2.74.6 Ability to view and modify room device operational parameters. It shall be possible to set device parameters independently for normal hours and after hours operation including sensor time delays and sensitivities, and load response to sensor including Manual-On or Auto-On
- 2.74.7 Ability to set up schedules for rooms and panels, view and override current status of panel channels and relays, and assign relays to groups. Schedules shall automatically set controlled zones or areas to either a normal hours or after hours mode of operation. Support for a minimum of 100 unique schedules, each with up to four time events per day. Support for annual schedules, holiday schedules and unique date-bound schedules
- 2.74.8 Ability to group rooms and loads for common control by schedules, switches or network commands
- 2.74.9 Ability to monitor connected load current and display power consumption for areas equipped with room controllers incorporating the integral current monitoring feature
- 2.74.10 Provide capabilities for integration with a BAS via BACnet protocol. At a minimum, the following points shall be available to the BAS via BACnet IP connection to the segment manager: room occupancy state; room schedule mode; room switch lock control; individual occupancy sensor state; room lighting power; room plug-load power; load ON/OFF state; load dimming level; panel channel schedule state; panel relay state; and Segment Manager Group schedule state control
- 2.74.11 The Segment Manager shall allow access and control of the overall system database via Native Niagara AX FOX connectivity. Systems that must utilize a Tridium Niagara controller in addition to the programming, scheduling and configuration server are not acceptable

2.75 Segment Manager shall support multiple DLM rooms as follows

- 2.75.1 Support up to 120 network bridges and 900 digital in-room devices (LMSM-3E)
- 2.75.2 Support up to 300 network bridges and 2,200 digital in room devices, connected via network routers and switches (LMSM-6E)
- 2.76 WattStopper Product Numbers: LMSM-3E, LMSM-6E, NB-ROUTER, NB-SWITCH, NB-SWITCH-8, NB-SWITCH-16

PROGRAMMING, CONFIGUARION AND DOCUMENTATION SOFTWARE

- 2.77 PC-native application for optional programming of detailed technician-level parameter information for all DLM products, including all parameters not accessible via BACnet and the handled IR configuration tool. Software must be capable of accessing room-level parameter information locally within the room when connected via the optional LMCI-100 USB programming adapter, or globally for many segment networks simultaneously utilizing standard BACnet/IP communication. Additional parameters exposed through this method include but are not limited to:
 - 2.77.1 Occupancy sensor detection LED disable for performance and other aesthetic spaces where blinking LEDs present a distraction.
 - 2.77.2 Six occupancy sensor action behaviors for each controlled load, separately configurable for normal hours and after hours modes. Modes include: No Action, Follow Off Only, Follow On Only, Follow On and Off, Follow On Only with Override Time Delay, Follow Off Only with Blink Warn Grace Time, Follow On and Off with Blink Warn Grace Time.
 - 2.77.3 Separate fade time adjustments per load for both normal and after hours from 0 - 4 hours.
 - 2.77.4 Configurable occupancy sensor re-trigger grace period from 0 - 4 minutes separate for both normal hours and after hours.
 - 2.77.5 Separate normal hours and after hours per-load button mode with modes including: Do nothing, on only, off only, on and off.
 - 2.77.6 Load control polarity reversal so that on events turn loads off and vice versa.
 - 2.77.7 Per-load DR (demand response) shed level in units of percent.
 - 2.77.8 Load output pulse mode in increments of 1second.
 - 2.77.9 Fade trip point for each load for normal hours and after hours that establishes the dimmer command level at which a switched load closes its relay to allow for staggered On of switched loads in response to a dimmer
- 2.78 Generation of reports at the whole file, partial file, or room level. Reports include but are not limited to:

- 2.78.1 Device list report: All devices in a project listed by type.
- 2.78.2 Load binding report: All load controller bindings showing interaction with sensors, switches, and daylighting.
- 2.78.3 BACnet points report: Per room Device ID report of the valid BACnet points for a given site's BOM.
- 2.78.4 Room summary report: Device manifest for each room, aggregated by common BOM, showing basic sequence of operations.
- 2.78.5 Device parameter report: Per-room lists of all configured parameters accessible via hand held IR programmer for use with O&M documentation.
- 2.78.6 Scene report: All project scene pattern values not left at defaults (i.e. 1 = all loads 100%, 2 = all loads 75%, 3 = all loads 50%, 4 = all loads 25%, 5-16 = same as scene 1).
- 2.78.7 Occupancy sensor report: Basic settings including time delay and sensitivity(ies) for all occupancy sensors
- 2.79 Network-wide programming of parameter data in a spreadsheet-like programming environment including but not limited to the following operations
 - 2.79.1 Set, copy/paste an entire project site of sensor time delays.
 - 2.79.2 Set, copy/paste an entire project site of sensor sensitivity settings.
 - 2.79.3 Search based on room name and text labels.
 - 2.79.4 Filter by product type (i.e. LMRC-212) to allow parameter set by product.
 - 2.79.5 Filter by parameter value to search for product with specific configurations
- 2.80 Network-wide firmware upgrading remotely via the BACnet/IP network
 - 2.80.1 Mass firmware update of entire rooms
 - 2.80.2 Mass firmware update of specifically selected rooms or areas
 - 2.80.3 Mass firmware upgrade of specific products
- 2.81 WattStopper Product Number: LMCS-100, LMCI-100

LMCP LIGHTING CONTROL PANELS

- 2.82 Provide lighting control panels in the locations and capacities as indicated on the plans and schedules. Each panel shall be of modular construction and consist of the following components:

- 2.82.1 Enclosure/Tub shall be NEMA 1, sized to accept an interior with 1 - 8 relays, 1 - 24 relays and 6 four-pole contactors, or 1 - 48 relays and 6 four-pole contactors
- 2.82.2 Cover shall be configured for surface or flush wall mounting of the panel as indicated on the plans. The panel cover shall have a hinged and lockable door with restricted access to line voltage section of the panel
- 2.82.3 Interior assembly shall be supplied as a factory assembled component specifically designed and listed for field installation. The interior construction shall provide total isolation of high voltage (Class 1) wiring from low voltage (Class 2) wiring within the assembled panel. The interior assembly shall include intelligence boards, power supply, DIN rails for mounting optional Class 2 control devices, and individually replaceable latching type relays. The panel interiors shall include the following features
 - 2.82.3.1 Removable, plug-in terminal blocks with connections for all low voltage terminations
 - 2.82.3.2 Individual terminal block, override pushbutton, and LED status light for each relay
 - 2.82.3.3 Direct wired switch inputs associated with each relay shall support 2-wire momentary switches only
 - 2.82.3.4 Digital inputs (four RJ-45 jacks) shall support 1-, 2-, 3-, 4-, and 8-button digital switches; digital IO modules capable of receiving 0-5V or 0-10V analog photocell inputs; digital IO modules capable of receiving momentary or maintained contact closure inputs or analog sensor inputs; digital daylighting sensors; and digital occupancy sensors. Inputs are divided into two separate digital networks, each capable of supplying 250mA to connected devices
 - 2.82.3.5 True relay state shall be indicated by the on-board LED and shall be available to external control devices and systems via BACnet
 - 2.82.3.6 Automatically sequenced operation of relays to reduce impact on the electrical distribution system when large loads are controlled simultaneously
 - 2.82.3.7 Group and pattern control of relays shall be provided through a simple keypad interface from a handheld IR programmer. Any set of relays can be associated with a group for direct on/off control or pattern (scene) control via a simple programming sequence using the relay override pushbuttons and LED displays for groups 1-8 or a handheld IR programmer for groups 1-99
 - 2.82.3.8 Relay group status for shall be provided through LED indicators for groups 1-8 and via BACnet for groups 1-99. A solid LED

indicates that the last group action called for an ON state and relays in the group are on or in a mixed state

2.82.3.9 Single-pole latching relays with modular plug-in design. Relays shall provide the following ratings and features:

Electrical

- 2.82.3.9.1 30 amp ballast at 277V
- 2.82.3.9.2 20 amp ballast at 347V
- 2.82.3.9.3 20 amp tungsten at 120V
- 2.82.3.9.4 30 amp resistive at 347V
- 2.82.3.9.5 1.5 HP motor at 120V
- 2.82.3.9.6 14,000 amp short circuit current rating (SCCR) at 347V
- 2.82.3.9.7 Relays shall be specifically UL 20 listed for control of plug-loads

Mechanical

- 2.82.3.9.8 Replaceable, ½" KO mounting with removable Class 2 wire harness
- 2.82.3.9.9 Actuator on relay housing provides manual override and visual status indication, accessible from Class 2 section of panel
- 2.82.3.9.10 Dual line and load terminals each support two #14 - #12 solid or stranded conductors
- 2.82.3.9.11 Tested to 300,000 mechanical on/off cycles

- 2.83 Isolated low voltage contacts provide for true relay status feedback and pilot light indication
- 2.84 Power supply shall be a multi-voltage transformer assembly with rated power to supply all electronics, occupancy sensors, switches, pilot lights, and photocells as necessary to meet the project requirements. Power supply to have internal over-current protection with automatic reset and metal oxide varistor protection
- 2.85 Where indicated, lighting control panels designated for control of emergency lighting shall be provided with factory installed provision for automatic by pass of relays controlling emergency circuits upon loss of normal power. Panels shall be properly listed

and labeled for use on emergency lighting circuits and shall meet the requirements of UL924 and NFPA 70 - Article 700

- 2.86 Integral system clock shall provide scheduling capabilities for panel-only projects without DLM segment networks or BAS control
 - 2.86.1 Each panel shall include digital clock capability able to issue system wide automation commands to up to (11) eleven other panels for a total of (12) twelve networked lighting control panels. The clock shall provide capability for up to 254 independent schedule events per panel for each of the ninety-nine system wide channel groups
 - 2.86.2 The clock capability of each panel shall support the time-based energy saving requirements of applicable local energy codes
 - 2.86.3 The clock module shall provide astronomic capabilities, time delays, blink warning, daylight savings, and holiday functions and will include a battery back up for the clock function and program retention in non-volatile FLASH memory. Clocks that require multiple events to meet local code lighting shut off requirements shall not be allowed
 - 2.86.4 The clock capability of each panel shall operate on a basis of ON/OFF or Normal Hours/After Hours messages to automation groups that implement pre-configured control scenarios. Scenarios shall include:
 - 2.86.4.1 Scheduled ON / OFF
 - 2.86.4.2 Manual ON / Scheduled OFF
 - 2.86.4.3 Astro ON / OFF (or Photo ON / OFF)
 - 2.86.4.4 Astro and Schedule ON / OFF (or Photo and Schedule ON / OFF)
 - 2.86.5 The user interface shall be a portable IR handheld remote control capable of programming any panel in the system (LMCT-100)
 - 2.86.6 The clock capability of each panel shall employ non-volatile memory and shall retain user programming and time for a minimum of 10 years
 - 2.86.7 Schedules programmed into the clock of any one panel shall be capable of executing panel local schedule or Dark/Light (photocell or Astro) events for that panel in the event that global network communication is lost. Lighting control panels that are not capable of executing events independently of the global network shall not be acceptable
- 2.87 The lighting control panel can operate as a stand-alone system, or can support schedule, group, and photocell control functions, as configured in a Segment Manager controller, via a segment network connection

- 2.88 The lighting control panel shall support digital communications to facilitate the extension of control to include interoperation with building automation systems and other intelligent field devices. Digital communications shall be RS485 MS/TP-based using the BACnet® protocol
- 2.88.1 The panel shall have provision for an individual BACnet device ID and shall support the full 2^{22} range (0 – 4,193,304). The device ID description property shall be writable via the network to allow unique identification of the lighting control panel on the network
- 2.88.2 The panel shall support MS/TP MAC addresses in the range of 0 – 127 and baud rates of 9600k, 38400k, 76800k, and 115.2k bits per second
- 2.88.3 Lighting control relays shall be controllable as binary output objects in the instance range of 1 – 64. The state of each relay shall be readable and writable by the BAS via the object present value property
- 2.88.4 Lighting control relays shall report their true on/off state as binary input objects in the instance range of 1 – 64
- 2.88.5 The 99 group Normal Hours/After Hours control objects associated with the panel shall be represented by binary value objects in the instance range of 201 – 299. The occupancy state of each channel group shall be readable and writable by the BAS via the object present value property. Commanding 1 to a channel group will put all relays associated with the channel into the normal hours mode. Commanding 0 or NULL shall put the relays into the after hours mode
- 2.88.6 Setup and commissioning of the panel shall not require manufacturer-specific software or a computer. All configuration of the lighting control panel shall be performed using standard BACnet objects or via the handheld IR programming remote. Provide BACnet objects for panel setup and control as follows:
- 2.88.6.1 Binary output objects in the instance range of 1 – 64 (one per relay) for on/off control of relays
- 2.88.6.2 Binary value objects in the instance range of 1 – 99 (one per channel) for normal hours/after hours schedule control
- 2.88.6.3 Binary input objects in the instance range of 1 – 64 (one per relay) for reading true on/off state of the relays
- 2.88.6.4 Analog value objects in the instance range of 101 – 199 (one per channel group) shall assign a blink warn time value to each channel. A value of 5 shall activate the blink warn feature for the channel and set a 5-minute grace-time period. A value of 250 shall activate the sweep feature for the channel and enable the use of sweep type automatic wall switches

- 2.88.7 The description property for all objects shall be writable via the network and shall be saved in non-volatile memory within the panel
- 2.88.8 The BO and BV 1 – 99 objects shall support BACnet priority array with a relinquish default of off and after hours respectively. Prioritized writes to the channel BV objects shall propagate prioritized control to each member relay in a way analogous to the BACnet Channel object described in addendum aa. (<http://www.bacnet.org/Addenda/Add-135-2010aa.pdf>)
- 2.88.9 Panel-aggregate control of relay Force Off at priority 2 shall be available via a single BV5 object. Force On at priority 1 shall be available via a single BV4 object
- 2.88.10 Lockout of all digital switch buttons connected to a given panel shall be command-able via a single BV2 object. The lock status of any connected switch station shall be represented as BV101-196

2.89 WattStopper Product Number: LMCP8, LMCP24 or LMCP48

USER INTERFACE

- 2.90 Each lighting control panel system shall be supplied with at least (1) handheld configuration tool (LMCT-100). As a remote programming interface the configuration tool shall allow setup, configuration, and diagnostics of the panel without the need for software or connection of a computer. The user interface shall have the following panel-specific functions as a minimum:
 - 2.90.1 Set network parameters including panel device ID, MS/TP MAC address, baud rate and max master range.
 - 2.90.2 Relay Group creation of up to 99 groups. Group creation shall result in programming of all seven key relay parameters for member relays. The seven parameters are as follows: After-hours Override Time Delay, Normal Hours Override Time Delay, Action on Transition to Normal Hours, Action on Transition to After Hours, Sensor Action During Normal Hours, Sensor Action During After Hours, Blink-Warn Time for After Hours.
 - 2.90.3 Program up to 254 separate scheduled events. Events shall occur on seven day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays. Holidays are also defined through the User Interface.
 - 2.90.4 Program up to 32 separate Dark/Light events. Events shall have a selectable source as either calculated Astro with delay, or a digital IO module with an integral 0-5V or 0-10V analog photocell. Dark/Light events shall occur on seven day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays.

- 2.90.5 Button binding of digital switches to groups shall be accessible via the handheld IR remote and accomplished from the digital switch station.
- 2.90.6 Programming of panel location information shall be accomplished by the handheld IR remote and include at a minimum LAT, LON, DST zone, and an approximate city/state location.
- 2.90.7 An additional handheld IR remote may optionally be specified to be permanently mounted to the panel interior via a retractable anti-theft lanyard to allow for convenient programming of the panel while assuring that the handheld programmer is always present at that panel. An unlimited number of handheld IR remotes may also be purchased for facilities staff as determined by the end user's representative.

2.91 WattStopper Product Number: LMCT-100

EMERGENCY LIGHTING CONTROL DEVICES

2.92 Emergency Lighting Control Unit – A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides normal ON/OFF control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include:

- 2.92.1 120/277 volts, 50/60 Hz, 20 amp ballast rating
- 2.92.2 Push to test button
- 2.92.3 Auxiliary contact for remote test or fire alarm system interface

2.93 WattStopper Product Numbers: ELCU-100, ELCU-200

PART 3 - EXECUTION

PRE-INSTALLATION MEETING

- 3.1 A factory authorized manufacturer's representative shall provide the electrical contractor a functional overview of the lighting control system prior to installation. The contractor shall schedule the pre-installation site visit after receipt of approved submittals to review the following:
 - 3.1.1 Confirm the location and mounting of all digital devices, with special attention to placement of occupancy and daylighting sensors.
 - 3.1.2 Review the specifications for low voltage control wiring and termination.
 - 3.1.3 Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.

3.1.4 Discuss requirements for integration with other trades

CONTRACTOR INSTALLATION AND SERVICES

- 3.2 Contractor to install all devices and wiring in a professional manner. All line voltage connections to be tagged to indicate circuit and switched legs
- 3.3 Contractor to install all room/area devices using manufacturer's factory-tested Cat 5e cable with pre-terminated RJ-45 connectors. If pre-terminated cable is not used for room/area wiring, the contractor is responsible for testing each field-terminated cable following installation, and shall supply the lighting controls manufacturers with test results. Contractor to install any room to room network devices using manufacturer-supplied LM-MSTP network wire. Network wire substitution is not permitted and may result in loss of product warranty per DLM SEGMENT NETWORK section of specification. Low voltage wiring topology must comply with manufacturer's specifications. Contractor shall route network wiring as shown in submittal drawings as closely as possible, and shall document final wiring location, routing and topology on as built drawings
- 3.4 Install the work of this Section in accordance with manufacturer's printed instructions unless otherwise indicated. Before start up, contractor shall test all devices to ensure proper communication
- 3.5 Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings
 - 3.5.1 Adjust time delay so that controlled area remains lighted while occupied
- 3.6 Provide written or computer-generated documentation on the configuration of the system including room by room description including:
 - 3.6.1 Sensor parameters, time delays, sensitivities, and daylighting setpoints.
 - 3.6.2 Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
 - 3.6.3 Load Parameters (e.g. blink warning, etc)
- 3.7 Post start-up tuning – After 30 days from occupancy contractor shall adjust sensor time delays and sensitivities to meet the Owner's requirements. Provide a detailed report to the Architect / Owner of post start-up activity

FACTORY SERVICES

- 3.8 Upon completion of the installation, the manufacturer's factory authorized representative shall start up and verify a complete fully functional system

- 3.9 The electrical contractor shall provide both the manufacturer and the electrical engineer with three weeks written notice of the system start up and adjustment date
- 3.10 Upon completion of the system start up, the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system

COMMISSIONING SUPPORT SERVICES

- 3.11 On this project, a commissioning agent will be hired to verify the installation and programming of all building systems, which includes the lighting control system. Manufacturer should include an extra day of technician's time to review the functionality and settings of the lighting control hardware with the commissioning agent, including reviewing submittal drawings and ensuring that instructions on how to configure each device are readily available. Manufacturer is NOT responsible for helping the commissioning agent inspect the individual devices. It will be the commissioning agent's responsibility to create and complete any forms required for the commissioning process, although the manufacturer or contractor may offer spreadsheets and/or printouts to assist the agent with this task.
- 3.12 The commissioning agent shall work with the electrical contractor during installation of the lighting control hardware to become familiar with the specific products. The agent may also accompany the manufacturer's technicians during their start-up work to better understand the process of testing, calibration and configuration of the products. However, the contractor and manufacturer shall ensure that interfacing with the agent does not prevent them from completing the requirements outlined in the contract documents

ACCEPTANCE TESTING SUPPORT SERVICES

- 3.13 On all California projects, a certified lighting controls acceptance test technician (CLCATT) must verify the installation of the lighting control system. Manufacturer should include an extra day of factory technician's time to assist the CLCATT review the functionality and settings of the lighting control hardware per the requirements in the California State forms. It will be the CLCATT's responsibility to create and complete any forms required for the commissioning process, although the manufacturer or contractor may offer spreadsheets and/or printouts to assist the CLCATT with this task

END OF SECTION 260923

SECTION 262413 – SWITCHBOARDS

PART 1 – GENERAL

- 1.1 Furnish and install service entrance and distribution switchboards as herein specified and as shown on the drawings. In order to establish the minimum acceptable quality and type of equipment described in this section, the switchboard was technically and dimensionally designed around "Square D." If other acceptable manufacturer products listed in 2.1 are used, it shall be the responsibility of the Contractor to verify the equipment will meet the requirements of the design, both technically and dimensionally.
- 1.2 All electrical materials and equipment shall be new, and of the type and quality specified: Listed by Underwriters' Laboratories, and bear their label, where standards have been established; in compliance with the applicable standards of CEC (NFPA 70), NFPA, ANSI, IEEE, IPCEA and NEMA. All components and equipment enclosures shall be manufactured by the same manufacturer.
- 1.3 SUBMITTALS
 - 1.3.1 Submit shop drawings and manufacturers' data on the switchboard and components including:
 - 1.3.1.1 Equipment elevation diagrams indicating the bussing configurations and ampere ratings.
 - 1.3.1.2 Coordination study and incident energy level calculations.
 - 1.3.1.3 Metering equipment
 - 1.3.1.4 Breakers or fused switches
 - 1.3.1.5 Surge Protective Device (SPD)
- 1.4 **Common submittal mistakes which will result in the submittals being rejected:**
 - 1.4.1 Not including the Short Circuit and Coordination Study with the material submittals.
 - 1.4.2 Not including all items listed in the above itemized description.
 - 1.4.3 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
 - 1.4.4 Not including actual manufacturer's catalog information of proposed products.

- 1.4.5 Do not include multiple manufacturers for similar products and do not indicate “or approved equal” statements, or “to be determined later” statements. The products being submitted must be the products installed.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

2.1.1 Acceptable manufacturers are:

2.1.1.1 Siemens

2.1.1.2 Eaton

2.1.1.3 Square D

2.1.1.4 General Electric

- 2.2 Equipment manufactured by any other manufacturers not specifically listed in Section 2.1, are not considered equal or approved for use on this project.

- 2.3 Switchboards shall be of the dead front, safety type with voltage and ampere capacity as indicated. Provide a 25% minimum tin plated aluminum ground bus running the full length of the switchboards. The neutral bus shall be **100%** rated throughout.

- 2.4 Where conductor sizes exceed the standard breaker lug wire range, or where multiple conductors per phase are required, the manufacturer shall provide the breaker with suitable lugs for terminating the specified conductors.

- 2.5 All bussing shall be tin plated aluminum and braced for a short circuit current of 100,000 RMS symmetrical amperes minimum, or as noted on the drawings. Horizontal and vertical bussing shall be 100% fully rated; not tapered unless otherwise noted on the drawings. All sections shall have full height bus.

- 2.6 The main circuit breaker (480 volt or 208 volt, 800 amp or larger) shall be a stored energy solid state trip insulated case type breaker and shall consist of a three-pole electrically and mechanically trip-free circuit breaker with inter-pole barriers, arc quenchers, manual stored-energy closing mechanism, mechanical push-button trip, position indicator, and equipped for fixed mounting in the switchboard section. Main breaker shall be **100%** rated and shall be sized as indicated on the drawings. Minimum short circuit interrupting rating shall be 65,000 ampere symmetrical for all breakers in the main switchboard or as indicated on the drawings. For main breakers rated 2,500 amps and larger this rating shall be increased to 100,000 amps, or as indicated on the drawings.

- 2.6.1 The over current trip devices to be furnished with the main circuit breaker shall be of the three-phase construction and employ solid-state components in their design to afford combinations of long, short time,

and instantaneous and ground fault characteristics (480 volt only) as specified. The circuit breaker and integral solid-state trip device shall be self-contained to include necessary power supply, transformers and tapped current level sensing transformers. An external source shall not be required to trip the circuit breaker under fault of overload conditions or to test the ground fault trip.

- 2.6.2 Field installed rating plug taps shall be provided.
- 2.6.3 Main breakers 400 amp and larger shall be solid state trip.
- 2.6.4 The main circuit breaker shall be provided with the following:
 - 2.6.4.1 Adjustable longtime delay element pickup.
 - 2.6.4.2 Adjustable short-time delay element pickup.
 - 2.6.4.3 The instantaneous trip element pickup shall be adjustable from 1.5 to 10 times the sensor setting or none.
- 2.6.5 The feeder circuit breakers (480 volt or 208 volt, 400 amp or larger) shall be solid state trip molded case type breakers. They shall consist of a three-pole electrically and mechanically trip-free circuit breakers with inter-pole barriers, arc quenchers, manual closing mechanism, position indicator, and equipped for fixed mounting in the switchboard section. The breakers shall be a minimum of **80%** rated, unless otherwise identified on the drawings and shall be sized as indicated on the drawings. Minimum short circuit interrupting rating shall be 65,000 ampere symmetrical or as indicated on the drawings.
 - 2.6.5.1 The overcurrent trip devices to be furnished with these circuit breakers shall be of the three-phase construction and employ solid-state components in their design to afford combinations of long, short time, and instantaneous and ground fault characteristics (480 volt only) as specified. The circuit breaker and integral solid-state trip device shall be self-contained to include necessary power supply, transformers and tapped current level sensing transformers. An external source shall not be required to trip the circuit breaker under fault of overload conditions or to test the ground fault trip.
 - 2.6.5.2 Field installed rating plug taps shall be provided as required.
 - 2.6.5.3 These circuit breakers shall be provided with the following:
 - 2.6.5.3.1 Adjustable long-time delay element pickup.
 - 2.6.5.3.2 Adjustable short-time delay element pickup.

2.6.5.3.3 The instantaneous trip element pickup shall be adjustable from 1.5 to 10 times the sensor setting.

2.6.5.3.4 Where the GFI function is required the settings shall be set at maximum levels.

2.7 Feeder breakers identified as 100% rating on the drawings may be molded case type below 1600 amp but 1600 amp and above shall be insulated case type. All breakers shall accept copper or aluminum conductors. Contractor must verify that the breaker can accept the possibility of aluminum conductors.

2.8 Circuit breakers less than 400 amps shall be molded case, trip free, quick-make, quick-break, thermal magnetic type, with handles clearly indicating rating and position-on, off, tripped.

2.9 Circuit breakers used in service entrance equipment, identified on the drawings shall have short circuit current ratings equal to the bracing and in no case smaller than 22,000 amperes RMS symmetrical.

2.10 The switchboard shall be manufactured to locate the utility company metering within the local utility company requirements, for maximum centerline height. This maximum height must include the 2-1/2" high (above finished grade) concrete housekeeping.

2.11 Provide a metal embossed nameplate adjacent to the switchboard rating, indicating the maximum short circuit current rating of the switchboard as determined by UL 891, September 30, 1982.

2.12 Where devices indicated are fusible type, fuses shall be Bussman or Littlefuse (no known equal).

2.13 Where a switchboard is indicated to be provided with an NEMA 3R (weatherproof) enclosure, the enclosure shall be manufactured to allow the equipment to mount flush against a vertical surface or wall. Rear roof equipment overhangs will not be permitted for weatherproof equipment.

2.14 Where auxiliary test kits or other devices are needed for setting breaker parameters they shall be supplied.

Service Entrance – Surge Protective Device

2.15 IEEE C62.41.1, IEEE Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits

2.16 IEEE C62.41.2, IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

2.17 IEEE C62.45, IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits

- 2.18 National Electrical Code: Article 285
- 2.19 UL 1283 - Electromagnetic Interference Filters
- 2.20 SPD shall be UL 1449 labeled as Type 1 or Type 4 intended for Type 1 applications, verifiable at UL.com without need for external or supplemental over current controls. Every suppression component of every mode, including N-G, shall be protected by internal over current and thermal over temperature controls. SPDs relying upon external or supplementary installed safety disconnectors do not meet the intent of the specification
- 2.21 SPD shall be factory installed integral to electrical distribution equipment
- 2.22 SPD shall be UL labeled with 20kA I-nominal (I-n)
- 2.23 SPD shall be UL labeled with 200kA Short Circuit Current Rating (SCCR)
- 2.24 Standard Mode Protection paths: SPD shall provide surge current paths for all modes of protection: L-N, L-G, L-L, and N-G for Wye systems.
- 2.25 SPD shall be connected to the buss of the distribution equipment with an appropriately sized 200kA SCCR rated disconnect
- 2.26 SPD shall meet or exceed the following criteria:

2.26.1 MAXIMUM 7-Mode sure current capability per phase shall be 400kA for mountain and desert areas with over 5 lightning strikes per year.

2.26.2 UL 1449 – Third Edition Revisions; effective September 29, 2009
Voltage Protection Ratings shall not exceed the following:

<u>VOLTAGE</u>	<u>L-N</u>	<u>L-G</u>	<u>N-G</u>	<u>L-L</u>	<u>MCOV</u>
208Y/120	700V	700V	700V	1200V	150V
480Y/277	1200V	1200V	1200V	2000V	320V

2.26.3 UL 1449 Listed Maximum Continuous Operating Voltage (MCOV)
(verifiable at UL.com)

<u>System Voltage</u>	<u>Allowable System Voltage Fluctuation (%)</u>	<u>MCOV</u>
208Y/120	25%	150V
480Y/277	15%	320V

- 2.27 SPD shall incorporate a UL 1283 listed EMI/RFI filter with minimum attenuation of -50dB at 100 kHz
- 2.28 Suppression components shall be heavy duty ‘large block’ MOVs, each exceeding 30mm diameter.

- 2.29 SPD shall include a serviceable, replaceable module.
- 2.30 SPD shall be equipped with the following diagnostics:
 - 2.30.1 Visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service Led
 - 2.30.2 Audible alarm with on/off silence function and diagnostic test function (excluding branch)
 - 2.30.3 Form C dry Contacts

No other test equipment shall be required for SPD monitoring or testing before or after installation.

- 2.30.4 SPD shall have a 10 year warranty

Short-Circuit and Coordination Studies

- 2.31 The contractor shall provide the following studies; a time current and complete short-circuit study, equipment-interrupting or withstand evaluation, and a protective-device coordination study as described below for the distribution system. The equipment study shall be included with the equipment submittals. The studies shall include all portions of the electrical distribution system from the normal and alternate sources of power throughout the low-voltage distribution system. Normal system operating method, alternate operation, and operations which could result in maximum-fault conditions shall be thoroughly covered in the study. The studies are to be reviewed by a Professional Engineer registered in the State of California.
 - 2.31.1 **All studies shall be performed by “Emerson Electric” (858) 695-9551, MTA (858) 472-0193, or Terra Power Solutions (858) 380-8170. Studies performed by manufactures or other engineering or testing companies must submit qualifications for approval by Johnson Consulting Engineers, 7 days prior to bid for this project.**
- 2.32 Short-Circuit Study
 - 2.32.1 The study shall be in accordance with applicable ANSI and IEEE standards.
 - 2.32.2 The study input data shall include the short-circuit single- and three-phase contributions from all sources, with the X/R ratio, the resistance and reactance components of each branch impedance, motor and generator contributions, base quantities selected, and all other applicable circuit parameters.
 - 2.32.3 Short-circuit momentary duties and interrupting duties shall be calculated on the basis of maximum available fault current at each switchgear bus,

switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboards, and other significant locations through the system.

- 2.32.4 For the portions of a system utilizing medium- and high-voltage breakers, separate calculations shall be made for one-half cycle (close and latch) currents and interrupting currents. Calculations shall be for three-phase and phase-to-ground faults at each bus under consideration.
- 2.32.5 For the portions of a system utilizing low-voltage breakers (less than 1,000 volts), calculations shall be made for three-phase and phase-to-ground interrupting currents at each bus under consideration.

2.33 Equipment Evaluation Study

- 2.33.1 An equipment evaluation study shall be performed to assure the adequacy of circuit breakers, controllers, surge arresters, busways, switches, and fuses by tabulating and comparing the short-circuit ratings of these devices with the maximum short-circuit momentary and interrupting duties. Series rating of over current protective devices shall be permitted to reduce the maximum available short circuit current to panelboard branch circuit breakers to no more than 10,000 amps symmetrical for the 120/208 volt system and 14,000 amps symmetrical for the 277/480 volt system.

2.34 Protective-Device Coordination Study

- 2.34.1 A protective-device coordination study shall be performed to select or to verify the selection of power fuse ratings, protective-relay characteristics and settings, ratios, and characteristics of associated voltage and current transformers, and low-voltage breaker trip characteristics and settings. Time current curves are to be colored to clearly indicate coordination.
- 2.34.2 The coordination study shall include all voltage classes of equipment from the source's incoming line protective device down to and including each motor control center and/or panelboard. The phase and ground over current protection shall be included as well as settings for all other adjustable protective devices. Ground fault settings are to, as a minimum coordinate with a downstream 50 amp branch circuit breaker.
- 2.34.3 Protective device selection and settings shall be in accordance with requirements of the National Electrical Code and the recommendations of the ANSI/IEEE Standard 399, as applicable.

2.35 Study Report

- 2.35.1 The results of the power-system studies shall be summarized in a final report. The report shall include the following sections:

- 2.35.1.1 Description, purpose, basis, and scope of the study and a single-line diagram of the portion of the power system which is included within the scope of study.
- 2.35.1.2 Tabulations of circuit breaker, fuse, and other equipment ratings versus calculated short-circuit duties and commentary regarding same.
- 2.35.1.3 Protective device coordination curves, with commentary.
- 2.35.1.4 The selection and settings of the protective devices shall be provided separately in a tabulated form listing circuit identification, IEEE device number, current transformer ratios, manufacturer, type, range of adjustment, and recommended settings. A tabulation of the recommended power fuse selection shall be provided for all fuses in the system.
- 2.35.1.5 Fault-current tabulations including a definition of terms and a guide for interpretation.
- 2.35.1.6 The report must be submitted with the material submittal for the engineers approval.

2.36 Implementation

- 2.36.1 The equipment manufacturer is to be responsible for providing over current devices which are in compliance with the results of the above study.

PART 3 – EXECUTION

- 3.1 Switchboard shall be provided with adequate lifting means and capable of being rolled or moved directly to the floor without the use of floor sills.
- 3.2 Switchboard installation shall be done in accordance with National Electrical Installation Standards (NECA 400-1998) for installing and maintaining switchboards.
- 3.3 Provide 2-1/2" concrete housekeeping pads for service entrance and distribution switchboards. For switchboards containing local utility company metering equipment, the concrete pad must be flush with the front edge of the switchboard enclosure.
- 3.4 Provide permanently affixed engraved nameplate stating UL listed fault current rating of switchboard assembly. Locate adjacent to the equipment nameplate on front of switchboard.
- 3.5 All lugs shall be torque tested in the presence of the inspector of record.

3.6 Arc Flash and Shock Hazard

- 3.6.1 The Contractor is to provide, and submit to the engineer for approval, incident energy level calculations as determined using the methodologies described in NFPA 70E or IEEE standard 1584-2002.
- 3.6.2 A warning label, as specified in the above standard, shall be placed on each switchboard, panelboard, and safety switch indicating the incident energy levels on the equipment to warn qualified personnel in accordance with NFPA 70E, section 110.16. Labels shall be laminated white micarta with black lettering on each. Letters shall be no less than 3/8" high. The label is not to identify the party performing the study but only the technical information needed.
- 3.6.3 The incident level calculations for each piece of equipment shall be given to the owner and maintained on file by the maintenance department.
- 3.6.4 The design goal is to minimize the incident energy to which a maintenance employee may be exposed.

END OF SECTION 262413

SECTION 262416 - PANEL BOARDS

PART 1 – GENERAL

- 1.1 Furnish and install branch circuit panel boards as specified herein and as indicated on the drawings. Submit manufacturers' data on all items.
- 1.2 Submit manufacturers' data on all panel boards and components including:
 - 1.2.1 Enclosures and covers
 - 1.2.2 Breakers
 - 1.2.3 Surge Protective Device (SPD) equipment
 - 1.2.4 Incident energy level calculations
 - 1.2.5 Common submittal mistakes which will result in the submittals being rejected:
 - 1.2.5.1 Not arranging the circuit breakers in panels to match the orientations indicated on the drawings. In other words, if a 30 amp breaker is shown on the drawing in Space #2, this must be the location it appears on the submittal schedule. Standard factory arrangements will not be accepted.
 - 1.2.5.2 Not including all items listed in the above itemized description.
 - 1.2.5.3 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
 - 1.2.5.4 Not including actual manufacturer's catalog information of proposed products.
 - 1.2.5.5 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements or "to be determined later" statements. The products being submitted must be the products installed.

PART 2 – PRODUCTS

- 2.1 The interrupting rating of circuit breakers shall be 10,000 amps for the 120/208 system and 14,000 amp for 277/480 volt systems. Refer to drawings for higher interrupting rating requirements. All components and equipment enclosures shall be manufactured by the same manufacturer. Circuit breakers shall be permitted to

be series rated to limit the available fault current to no more than the above ratings.

- 2.2 All panels shall be fully bussed. Recessed panel enclosures shall be a maximum of 20" wide and 5-3/4" deep for all panels 600 amp rated and less.
- 2.3 All busses shall be tin-plated aluminum and shall be located in the rear of the panelboard cabinet. Individual circuit breakers shall be bolt on type and removable from the cabinet without disturbing the bussing in any way. All panel boards shall contain ground busses.
- 2.4 Panel covers shall be door in door style, with one lock. Door lock shall allow access to breakers only. Access to wireways without removal of cover shall be permitted by (non removable) screws behind the locked door. Panel cover shall be provided with full length piano hinge. All locks for all panels provided in this project shall be keyed alike.
- 2.5 Each panel shall have a two-column circuit index card set under glass or glass equivalent on the inside of the door. Each circuit shall be identified as to use and room or area. Areas shall be designated by room numbers. Room numbers shown on the drawings may change and contractor shall verify final room numbers with the architect prior to project completion.
- 2.6 Tandem mounted or wafer type breakers are not acceptable.
- 2.7 Multiple breakers shall have one common trip handle or be internally connected. Handle ties are not acceptable.
- 2.8 Breaker arrangements shown in the drawings shall be maintained. The circuit breakers in panels must match the orientations indicated on the drawings. In other words, if a 30 amp breaker is shown on the drawing in Space #2, this must be the location it appears on the submittal schedule. Standard factory arrangements will not be accepted.
- 2.9 Where conductor sizes exceed the standard breaker lug wire range, or where multiple conductors per phase are required, the panelboard manufacturer shall provide the breaker with suitable lugs for terminating the specified conductors.
- 2.10 Acceptable manufacturers are Square D, Eaton, Siemens or General Electric.
- 2.11 Equipment manufactured by any other manufacturers not specifically listed in Section 2.10 are not considered equal, or approved for use on this project.

Surge Protective Device (SPD)

- 2.12 Surge Protective Device (SPD) panelboards, shall be provided with an integrated circuit breaker panelboard and parallel connected suppression / filter system in a single enclosure. The SPD panelboard shall meet the following parameters:

IEEE C62.41.1, IEEE C62.41.2, IEEE C62.45, UL 1283 and the UL 1449, Third Edition, effective September 29, 2009.

2.13 The panelboard shall be UL 67 Listed and the SPD shall be UL 1449 labeled as Type 1 or Type 2 or as Type 4 intended for Type 1 or Type 2 applications. SPD shall be factory installed integral to the panel board.

2.14 The SPD panelboard shall be top or bottom feed according to requirements. A circuit directory shall be located inside the door.

2.15 SPD shall meet or exceed the following criteria:

2.15.1 For standard areas supply SPD having 100kA per phase surge current capacity. For mountain and desert areas (areas with over 5 lightning strikes per year), SPD shall have a per phase surge current capacity of 200kA.

2.15.2 UL 1449 – Third Edition Revision; effective September 29, 2009, Voltage Protection Ratings shall not exceed the following:

<u>VOLTAGE</u>	<u>L-N</u>	<u>L-G</u>	<u>N-G</u>	<u>L-L</u>	<u>MCOV</u>
208Y/120	700V	700V	700V	1200V	150V
480Y/277	1200V	1200V	1200V	2000V	320V

2.15.3 SPD shall be UL labeled with 100kA Short Circuit Current Rating (SCCR).

2.16 UL 1449 - Third Edition Revision; effective September 29, 2009, Voltage Protection Ratings shall not exceed the following:

<u>VOLTAGE</u>	<u>L-N</u>	<u>L-G</u>	<u>N-G</u>	<u>L-L</u>	<u>MCOV</u>
208Y/120	700V	700V	700V	1200V	150V
480Y/277	1200V	1200V	1200V	2000V	320V

2.17 SPD shall be UL labeled with a minimum 100kVA short circuit rated (SCCR).

2.18 UL 1449 Listed Maximum Continuous Operating Voltage (MCOV) (verifiable at UL.com):

<u>System Voltage</u>	<u>Allowable System Voltage Fluctuation (%)</u>	<u>MCOV</u>
208Y/120	25%	150V
480Y/277	15%	320V

2.19 SPD shall incorporate a UL 1283 listed EMI/RFI filter with minimum attenuation of - 50dB at 100 kHz. No filtering is required for a 100kA SPD.

2.20 Suppression components shall be heavy duty ‘large block’ MOVs, each exceeding 30mm diameter.

- 2.21 Type 4 SPD shall include a serviceable, replaceable module.
- 2.22 SPD shall be equipped with the following diagnostics:
 - 2.22.1 Visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service LED.
 - 2.22.2 No other test equipment shall be required for SPD monitoring or testing before or after installation.
- 2.23 SPD shall have a response time no greater than 1/2 nanosecond
- 2.24 SPD shall have a 10 year warranty
- 2.25 The SPD panelboard shall have removable interior
- 2.26 The SPD panelboard main bus shall be aluminum and rated for the load current required
- 2.27 The SPD panelboard shall include a 200% rated neutral assembly with copper neutral bus
- 2.28 The unit shall be provided with a safety ground bus

(SPD) Quality Assurance

- 2.29 Manufacturer Qualifications: Engage a firm with at least 5 years experience in manufacturing transient voltage surge suppressors.
- 2.30 Manufacturer shall be ISO 9001 or 9002 certified.
- 2.31 The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of ten (10) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
- 2.32 The SPD shall be compliant with the Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC.

PART 3 – EXECUTION

- 3.1 Painting of panelboard covers in finished areas shall be done by the general contractor.
- 3.2 Provide a spare 3/4" conduit stubbed to an accessible area for each of every three (3) spares or spaces provided in recessed panel boards.
- 3.3 All lugs shall be torque tested in the presence of the inspector of record.

- 3.4 The Contractor is to provide, and submit to the engineer for approval, incident energy level calculations as determined using the methodologies described in NFPA 70E or IEEE standard 1584-2002.
- 3.4.1 **All studies shall be performed by “Emerson Electric” (858) 695-9551, MTA (858) 472-0193, or Terra Power Solutions (858) 380-8170. Studies performed by manufactures or other engineering or testing companies must submit qualifications for approval by Johnson Consulting Engineers, 7 days prior to bid for this project.**
- 3.5 A warning label, as specified in the above standard, shall be placed on each switchboard, panelboard, and safety switch indicating the incident energy levels on the equipment to warn qualified personnel in accordance with NFPA 70E, section 110.16 Labels shall be laminated white micarta with black lettering on each. Letters shall be no less than 3/8" high.
- 3.6 The incident level calculations for each piece of equipment shall be given to the owner and maintained on file by the maintenance department
- 3.7 The design goal is to minimize the incident energy to which a maintenance employee may be exposed.

END OF SECTION 262416

SECTION 262726 - SWITCHES AND RECEPTACLES

PART 1 – GENERAL

- 1.1 Furnish and install all wiring devices as shown on drawings and as herein specified. Unless otherwise noted, device and plate numbers shown are Hubbell and shall be considered the minimum standard acceptable. Other acceptable manufacturers are Pass and Seymour, Leviton, General Electric and Bryant.
- 1.2 Submit manufacturers' data on all items.
- 1.3 **Common submittal mistakes which will result in the submittals being rejected:**
 - 1.3.1 Not correctly indicating ampacity rating of proposed devices.
 - 1.3.2 Not including all items listed in the above itemized description.
 - 1.3.3 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
 - 1.3.4 Not including actual manufacturer's catalog information of proposed products.
 - 1.3.5 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements or "to be determined later" statements. The products being submitted must be the products installed.

PART 2 – PRODUCTS

- 2.1 All switches shall be of the quiet mechanical type, Specification Grade, 20 amp, 120/277 volt AC as follows:

	<u>HUBBELL</u>	<u>LEVITON</u>	<u>PASS & SEYMOUR</u>
Single Pole	CS120	CS1202	CS20AC1
Two Pole	CS1222	CS2202	CSB20AC2
Three-way	CS320	CS3202	CS20AC3
Key Switch	HBL1221L	1221-2L	PS20AC1-L

- 2.2 All switches shall have the "on" and the "off" position indicated on the handle. If switches of higher ampere ratings are required, they shall be of similar type and quality as those shown above. Groups of switches shown at one location shall be installed under a single plate up to a maximum of six where more than six switches are shown coordinate arrangement with the Architect.
- 2.3 Dimmer switches for incandescent lamp loads shall be square-law type, slide control dimmer with OFF position, Lutron or Hubbell "Nova-T" Series NT-600

(0-500 watt load), NT-1000 (501-900 watt load), NT-1500 (901-1500 watt load), or equal (no known equal).

- 2.4 All convenience receptacles and special outlets throughout shall be grounding type. Convenience receptacles shall be side wired, parallel slot, two pole, three wire, 20 amp as follows:

	<u>HUBBELL</u>	<u>LEVITON</u>	<u>PASS & SEYMOUR</u>
Duplex	5352	5362	PS5362
GFCI	GFR5362	7899	2097
Isolated Ground	IG5362	5362IG	IG6300
Tamper Proof		8300SG	TR63H

- 2.5 All safety or tamper proof receptacles shall have no exposed external current carrying metal parts and shall have integral wiring leads suitable for two or three wire installations.
- 2.6 Special receptacles shall be as noted on the drawings.
- 2.7 Weatherproof plates shall be designed to meet CEC Article 410-57, wet location listed with cover "open." Where weatherproof receptacles have been identified to be provided with locking covers, the cover shall be as manufactured by Pass & Seymour #4600-8 or Cole Lighting 310 Series. Rough-in requirements vary between manufacturers. Contractor to field verify requirements prior to installation.
- 2.8 All plates throughout shall be stainless steel. Where wiring devices are installed in concrete block walls, provide oversized 3-1/2" x 5" coverplates.
- 2.9 All devices shall be white unless otherwise noted or a special purpose outlet.
- 2.10 Unless where specifically detailed on the drawings, floor boxes shall be PVC suitable for concrete poured floors of minimum 3-1/2" depth, with a modular design to gang two or three sections together.
- 2.10.1 Carlon #E976 series or approved equal
- 2.10.2 Provide brass cover with brass carpet flange unless otherwise detailed.

PART 3 – EXECUTION

- 3.1 Switches for room lighting shall be located no more than 12" center line from door jamb at plus 48" center line above finished floor or +46" to top of devices where located over casework, reference CBC Figure 11B-5D.
- 3.2 All receptacles shall be mounted at plus 18" to center line above finished floor unless noted or shown otherwise. All receptacles shall be installed with the ground pin up, at the top of the receptacle to comply with IEEE 602-1986.

- 3.3 Furnish and install wall plates for all wiring devices, and outlet boxes, including special outlets, sound, communication, signal, and telephone outlets, etc. as required. All cover plates shall be appropriate for type of device.

END OF SECTION 262726

SECTION 262816 – DISCONNECTS

PART 1 – GENERAL

- 1.1 Furnish and install all disconnect switches as shown on the drawings and as required by the CEC.
- 1.2 Submit manufacturers' data for all disconnects and fuses.
 - 1.2.1 Disconnects
 - 1.2.2 Fuses
- 1.3 **Common submittal mistakes which will result in the submittals being rejected:**
 - 1.3.1 Not including all items listed in the above itemized description.
 - 1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
 - 1.3.3 Not including actual manufacturer's catalog information of proposed products.
 - 1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

PART 2 – PRODUCTS

- 2.1 Acceptable manufacturers shall be Square D, Cutler Hammer, Siemens or General Electric.
- 2.2 Equipment manufactured by any other manufacturers not specifically listed in Section 2.1 are not considered equal or approved for use on this project.
- 2.3 All switches shall be heavy-duty type, externally operated, quick-make, quick-break, rated 600 volts or 240 volts as required, with the number of poles and ampacity as noted. All switches for motors shall be HP rated. Switches shall have NEMA-Type 1 enclosures, except switches located where exposed to outdoor conditions shall have NEMA Type 3R enclosure. Switches generally shall be fused except where noted to be non-fused on the drawings.
- 2.4 Where fuses are indicated, fuses shall be Bussman or Littlefuse (no known equal). Fuses shall be current limiting type with time delay characteristics to suit the equipment served.

PART 3 – EXECUTION

- 3.1 Mount all switches to structure or U-channel support. U-channel supports shall be cleaned and painted to prevent rust.
- 3.2 Switches shall be accessible with proper clearances in front per CEC 110-16.
- 3.3 All lugs shall be torque tested in the presence of the inspector of record.
- 3.4 Arc Flash and Shock Hazard
 - 3.4.1 The contractor is to provide, and submit to the engineer for approval, incident energy level calculations as determined using the methodologies described in NFPA 70E or IEEE standard 1584-2002.
 - 3.4.2 A warning label, as specified in the above standard, shall be placed on each switchboard, panelboard, and safety switch indicating the incident energy levels on the equipment to warn qualified personnel in accordance with NFPA 70E, section 110.16 Labels shall be laminated white micarta with black lettering on each. Letters shall be no less than 3/8" high.
 - 3.4.3 The incident level calculations for each piece of equipment shall be given to the owner and maintained on file by the maintenance department.
 - 3.4.4 The design goal is to minimize the incident energy to which a maintenance employee may be exposed and in no case more than 8 cal./cm².

END OF SECTION 262816

SECTION 263323 - EMERGENCY LIGHTING EQUIPMENT

2

PART 1 – GENERAL

- 1.1 Furnish and install an uninterruptible emergency lighting Inverter System and Emergency Power Control Relays to provide a reliable source of emergency power, designed to operate during periods of utility line deficiencies without any interruption in power supplied to the connected load. The system shall provide and be capable of powering any combination of electronic, power factor corrected, fluorescent, LED, incandescent or HID lighting. Other connected loads shall include but not be limited to building management systems, motors, security systems and other critical voltage or frequency-sensitive electronic loads. The system shall operate from 0-100% loading and be rated to deliver full KVA rated output at unity power factor for a minimum of 90 minutes. Upon return to normal AC utility line power, the system shall recharge the batteries without any interruption of power supplied to the load.
- 1.2 The Inverter System shall be listed to or comply with these standards:
 - 1.2.1 UL 924 Standard for Emergency Lighting and Power Equipment
- 1.3 The Emergency Power Control Relay shall comply with UL 924
- 1.4 Submit Manufacturers' data sheets for all components including:
 - 1.4.1 Warranty
 - 1.4.2 Wiring diagrams
 - 1.4.3 Bill of materials.
 - 1.4.4 Product catalog sheets or equipment brochures.
 - 1.4.5 Product guide specifications.
 - 1.4.6 Installation information, including weights and dimensions.
 - 1.4.7 Drawings for requested optional accessories.
- 1.5 **Common submittal mistakes which will result in the submittals being rejected:**
 - 1.5.1 Not including all items listed in the above itemized description.
 - 1.5.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining, or clouding the items to be reviewed, or crossing out the items which are not applicable.
 - 1.5.3 Not including actual manufacturer's catalog information of proposed products.

- 1.5.4 Do not include multiple manufacturers for similar products and do not indicate “or approved equal” statements, or “to be determined later” statements. The products being submitted must be the products installed.

PART 2 - PRODUCTS

Single Phase systems 2000VA or less

- 2.1 The Central Inverter System specified herein shall be:
- 2.1.1 Dual Lite “Synchron” DLS Series Inverter System.
 - 2.1.2 Myers Power Products Illuminator CM series
 - 2.1.3 Alternate manufacturers shall comply with these specifications and shall not exceed the physical dimensions and weights indicated on the drawing schedule.
 - 2.1.4 All substitutions or alternates to those indicated shall be submitted for approval (7) days prior to the project bid date. Approvals when accepted will be issued in the form of an addendum. No consideration for substitutions will be provided after the award of the contract.
 - 2.1.5 The substitution request must include a statement indicating the difference in price of both the specified and alternate product, both contractor and list price. The substitution request must include a comparison of the features and capabilities between the specified and proposed systems, software and all components and warranty comparison.
 - 2.1.6 Equipment as manufactured by Digital Signal Power Manufacturer (DSPM) has been reviewed and is not an approved alternate for this project.

Single Phase systems over 2000VA

- 2.2 The Central Inverter System specified herein shall be:
- 2.2.1 Dual Lite “Spectron LSN” Series Inverter System.
 - 2.2.2 Myers Power Products Illuminator IE series
 - 2.2.3 Alternate manufacturers shall comply with these specifications and shall not exceed the physical dimensions and weights indicated on the drawing schedule.**
 - 2.2.4 All substitutions or alternates to those indicated shall be submitted for approval (7) days prior to the project bid date. Approvals when accepted will be issued in the form of an addendum. No consideration for substitutions will be provided after the award of the contract.
 - 2.2.5 The substitution request must include a statement indicating the difference in price of both the specified and alternate product, both contractor and list price.

The substitution request must include a comparison of the features and capabilities between the specified and proposed systems, software and all components and warranty comparison

- 2.2.6 Equipment as manufactured by Digital Signal Power Manufacturer (DSPM) has been reviewed and is not an approved alternate for this project.

Three Phase systems

- 2.3 The Central Inverter System specified herein shall be:
- 2.3.1 Myers Power Products Illuminator “CIH” series (interior) “DK” series (exterior)
- 2.3.2 Alternate manufacturers shall comply with these specifications and shall not exceed the physical dimensions and weights indicated on the drawing schedule.**
- 2.3.3** All substitutions or alternates to those indicated shall be submitted for approval (7) days prior to the project bid date. Approvals when accepted will be issued in the form of an addendum. No consideration for substitutions will be provided after the award of the contract
- 2.3.4 The substitution request must include a statement indicating the difference in price of both the specified and alternate product, both contractor and list price. The substitution request must include a comparison of the features and capabilities between the specified and proposed systems, software and all components and warranty comparison
- 2.3.5 Equipment as manufactured by Digital Signal Power Manufacturer (DSPM) has been reviewed and is not an approved alternate for this project.
- 2.4 System operation shall be fully automatic. The charging system will maintain the batteries at full capacity at all times. On-board microprocessors will continuously monitor charger settings and the system’s overall readiness. Diagnostic circuitry shall include a software-controlled charger, continuous monitoring of operating parameters, and programmable system testing capabilities. Individual alarms and system logs shall be provided. All alarms and logs shall be automatically recorded and readily displayed via the User Interface Display (UID). The system shall also include one RS232 serial port for remote communications.
- 2.5 Automatic overload and short circuit protection in normal and emergency mode shall consist of 150% momentary surge capability, 120% overload for 5 minutes, and 110% overload for 10 minutes. Protection shall also include a low battery voltage disconnect, AC input circuit breaker, a DC input breaker or Fuse, and an AC output fuse. A digitally generated sinusoidal output waveform (PWM) with less than 5% total harmonic distortion at rated linear load shall be provided to the connected load.
- 2.6 Available input voltage shall be as indicated on the drawings, with a frequency of 60Hz. The AIC rating shall be a minimum of 42,000 RMS symmetrical amperes.

- 2.7 Available output voltage shall be as indicated on the drawings, with a frequency of 60Hz + 0.05Hz.
- 2.8 The user interface display (UID) shall include an array of LED's, a 2-line, 40-character LCD display, and a keypad for system input. The UID shall be menu-driven and display individual system parameters using a numbered code (Hot Key). The LED array shall indicate, by color code, the following status modes:
 - 2.8.1 AC output presence (green)
 - 2.8.2 System ready (green)
 - 2.8.3 Battery charging (red)
 - 2.8.4 Inverter "ON" (amber)
 - 2.8.5 Alarm functions (red)
- 2.9 To ensure only authorized personnel have system access, a multi-level password shall be required to change all functions and operating parameters. A continuous scrolling display of the following metered functions shall be provided:
 - 2.9.1 AC input voltage, AC output voltage, AC output amps
 - 2.9.2 Battery voltage, Battery charging amps, Battery discharge amps
 - 2.9.3 Output volt-amps (VA), Output power (watts)
 - 2.9.4 Ambient temperature
 - 2.9.5 Last inverter run time, Total inverter run time, System run time, Date Time
- 2.10 Audible and visual alarms shall be provided, with automatic logging of the twenty-five most recent events. An alarm acknowledgment feature shall be provided, which will allow the user to silence only the current audible alarm without silencing other alarms or clearing the alarm condition until the fault has been addressed. An alarm shall be sounded if any of the following operating conditions occur:
 - 2.10.1 Low battery voltage, Near low battery voltage, High battery voltage
 - 2.10.2 High AC input voltage, High AC output voltage, Low AC output voltage Output, overload (VA), Low remaining run time
 - 2.10.3 High ambient temperature
 - 2.10.4 Tripped circuit breaker
- 2.11 Manual and automatic test modes shall be provided.
 - 2.11.1 Manual user-initiated system test at any time.

- 2.11.2 Automatic monthly and annual self-diagnostic tests.
- 2.11.3 Automatic recording of the last twenty events in a Test Results log.
- 2.12 A three-step float charger shall be software controlled and temperatures compensated, and charge the batteries continuously while in normal “standby” condition (non emergency mode). Following a power failure, the constant current charger mode shall be initiated until battery voltage reaches the equalize stage. Equalize stage shall be maintained until the charging current drops to .5 amps, or 0.3% of the battery amp/hour rating. Battery voltage shall then enter the float stage.
- 2.13 Batteries shall be designed to provide a minimum 1.5 hours rated output voltage to the connected load in emergency mode without dropping below 87.5% of nominal battery voltage.
 - 2.13.1 The batteries shall be encased in an enclosure that permits easy maintenance without requiring removal.
 - 2.13.2 Sealed Lead Calcium: Maintenance Free Construction requires no addition of water over its useful. Life expectancy is 10-years at 77F (25C) ambient temperature.
- 2.14 The following optional factory-installed equipment shall be provided:
 - 2.14.1 Normally-On Output Circuit Breaker Options:
 - 2.14.1.1 A maximum of fourteen monitored positions are available. Single pole 120V and 277V breakers occupy one position each, while double pole 240V breakers occupy two positions. Reference drawings for required number of output breakers required.
 - 2.14.2 Provide Universal cabinet locks for all electronic and battery cabinets.
 - 2.14.3 Provide, using the system’s RS232 port, a fax operating status reports is transmitted over a customer-supplied dedicated analog phone line to up to six locations. Phone numbers can be programmed locally using the unit keypad or computer terminal, or remotely via a modem. Each designated fax location automatically receives a unit status report following monthly and annual tests, or when an alarm condition is detected. Status reports include readings on key operating parameters, as well as complete alarm and inverter log printouts, in uncoded, user-friendly descriptions. This option also provides for two-way communications thru terminal emulation software, such as HyperTerminal (not supplied with the inverter system).
 - 2.14.4 Provide a factory-installed, internally-mounted two-position “make before break” switch. Compatible with all input/output combinations and any combination or quantity of output circuit breakers. Allows connecting the utility power supply to the load without placing the inverter in emergency mode.

- 2.15 Maintenance, Service and Enhanced Warranty Plans. The following shall be provided to assure initial and long-term viability of the system through additional maintenance and service plans and/or through enhancements to the standard two-year electronics limited warranty.
- 2.15.1 Factory Start-Up shall be supplied as a service to the installing contractor. The Factory Start-Up process shall verify correct installation and operation of the inverter system. Trained, factory authorized technicians shall administer an on-site, point-by-point check of the system to include:
- 2.15.1.1 Internal electrical connections
 - 2.15.1.2 AC input and Battery connections
 - 2.15.1.3 System operating voltages
 - 2.15.1.4 System operating parameters
 - 2.15.1.5 Initial system “power-up
 - 2.15.1.6 Battery discharge test
 - 2.15.1.7 Correction of existing deficiencies
 - 2.15.1.8 Final testing, calibration and recording
 - 2.15.1.9 Training of available operating personnel
- 2.15.2 A Monitoring Program shall provide for the continuous monitoring of the inverter system by the Factory Technical Support Group. All monthly and annual system tests shall be reviewed and analyzed for early warning signs of system malfunction. Any failures shall be automatically relayed to the service department where corrective action can be recommended to the owner/operator. For activation, a user supplied dedicated analog phone line must be available.
- 2.15.3 Preventive Maintenance Plan (PMP) - The Preventive Maintenance Plan shall provide system coverage beyond the standard two-year factory warranty. PMP warranty service excludes the batteries, which are covered under a separate warranty plan. Installation of a Fax Modem option shall be provided for Preventive Maintenance Plan.
- 2.15.3.1 Additional 2-year warranty and 2-year service coverage, weekdays, Monday-Friday, 8AM to 5PM EST. If the standard factory warranty has expired before selection and purchase of a PMP plan, an on-site evaluation shall be scheduled to determine if the system requires parts and/or labor to return to factory specifications. Parts and labor required shall be charged at additional costs.
- 2.16 The system shall be contained in a code gauge, steel NEMA 1 enclosure, finished in a scratch resistant, powder coat finish, with a key lock, conduit knockouts at the top and

sides, and front opening doors. Enclosures shall be designed to allow stacking to minimize the overall system's footprint. All components shall be front accessible and incorporate a modular design and a quick disconnect means to facilitate servicing.

Emergency Power Control Relays - (Noted on the drawings as LVS EPC Control relay)

- 2.17 Insert Series power control modules are designed to allow locally switched lighting fixtures to be wired for emergency operation from either generator, inverter system, or secondary sources.
- 2.18 As Manufactured by:
 - 2.18.1 "Highlights" HEPC Series Emergency Power Control modules (203) 575-2044 www.highliteslighting.com or approved equal.
 - 2.18.2 LVS Controls (800) 982-4587 www.lvscontrols.com.
- 2.19 During normal operation, LEDs on the module's faceplate indicate the presence of both utility (Green) and emergency (red) power and the local switch will be capable of turning all circuit lighting fixtures on or off as required. During utility power failures, emergency lighting fixtures controlled by the module will illuminate regardless of local switch position. If, during normal operation, emergency backup power is lost, the module will automatically produce an audible alarm as an alert to this potentially hazardous condition.
- 2.20 Recent energy mandates require improved vigilance in the conservation of resources. By eliminating the need for night light circuits, power controls conserve energy by allowing all area ambient lighting to be turned off while still assuring the availability of emergency illumination in the event of a utility power failure.
- 2.21 The power control automatically initiates a test of the emergency lighting fixtures whenever the local switch is turned off. Upon turning off of the local switch, the designated emergency lighting fixtures will remain illuminated for an additional 5 seconds to assure system readiness. The power controls may also be checked manually at any time through the integral test switch provided on the module's faceplate. With the local lighting turned off and both utility and emergency power present, pressing the test switch will cause the controlled emergency fixtures to illuminate for 5 seconds.
- 2.22 Adapts locally switched lighting fixtures for emergency operation, bypasses local switch during power failures. Compatible with motion detector and photocells.
- 2.23 Full 20 amp load capability available for 120 or 277VAC operation. Approved for in-wall or in-ceiling applications.
- 2.24 Provided with Surge and short circuit protection.
- 2.25 Audible emergency power circuit failure alarm, Built-in manual emergency circuit test feature, Momentary test switch.

- 2.26 Provide a single module at each emergency lighting fixture where the lighting fixture is locally controlled by a room switch and or motion sensor. These modules are to be furnished and installed by the contractor installing the lighting fixtures.
- 2.27 Provide a single module located at the panelboard or low voltage control panel to control emergency lights controlled from a low voltage control system. These modules are to be furnished and installed by the contractor installing the lighting fixtures.
- 2.28 Where dimmable light fixtures are on emergency circuit, provide emergency relay control, which is dimming compatible, and will bring lights to full brightness in emergency mode.
- 2.29 The Module has a full 5-year replacement warranty.

PART 3 - EXECUTION

- 3.1 Input and output conductors shall be enclosed in separate conduits. All load side wiring shall be sized as required for voltage drop conditions to assure proper operation of connected loads.
- 3.2 All free-standing electrical equipment or enclosures shall be anchored to the floor and braced at the top of the equipment to the structure. Where details have not been provided on the drawings, anchorage shall comply with CBC Section 1632A and Table 16-A0. The Contractor shall submit drawings signed by the Contractors registered structural Engineer indicating method of compliance prior installation.
- 3.3 The system shall allow connection of both “normally on” and “normally off” (optional) loads. Connected loads shall receive utility power during normal operation, and “no break” system inverter power during utility interruptions.
- 3.4 In emergency mode, the inverter system shall supply true digitally-generated AC sinusoidal output. Refer to plans for type and location of loads served by the system.
- 3.5 A factory trained service representative shall be dispatched to perform the initial system start-up.
- 3.6 Documents supplied with each system shall include:
 - 3.7 Shop drawings showing physical dimensions, mounting information and wiring diagrams.
 - 3.7.1 Installation/Users manual(s) for locating, mounting, interconnecting, and wiring the system, with operating and preventive maintenance procedures.
 - 3.7.2 The system shall be installed in accordance with all appropriate manufacturers’ instructions and in compliance with all appropriate codes.
- 3.8 The system shall be guaranteed, under normal and proper use, against defects in workmanship and materials for a period of two years from the date of shipment. Batteries

supplied as part of the systems shall be covered under a separate pro-rata warranty as described below:

3.8.1 Sealed Lead Calcium, 10-year life expectancy – One-year full replacement warranty plus an additional nine years pro-rata.

3.8.1.1 Note: Within 90days from date of shipment, batteries shall be connected to an energized charging system to maintain the Warranty. Battery life and capacity is rated at an optimum operating temperature range of 68F to 85F. Operating temperatures outside this range will affect battery life and capacity. Batteries are rated at 100% capacity at 77F.

3.9 Maintenance and service programs shall be made available by the supplier to assure long-term reliability of the system.

END OF SECTION 263323

SECTION 265114 - LED LIGHTING FIXTURES AND LAMPS

PART 1 – GENERAL

- 1.1 Furnish and install all lighting fixtures with lamps as specified and as shown on the drawings. Fixtures shall be complete including canopies, hanger, diffusers, ballasts, etc.
- 1.2 Submit manufacturer's data for each fixture type including the following:
 - 1.2.1 Lighting fixture catalog data and photometry.
 - 1.2.2 Lamp catalog data for each fixture type.
 - 1.2.3 Driver catalog data for each fixture type.
 - 1.2.4 Fixture warranty.
- 1.3 **Common submittal mistakes which will result in the submittal being rejected:**
 - 1.3.1 Not including lamp and driver information for each fixture type.
 - 1.3.2 Not including all items listed in the above itemized description.
 - 1.3.3 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
 - 1.3.4 Not including actual manufacturer's catalog information of proposed products.
 - 1.3.5 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

PRODUCT SUBSTITUTION

- 1.4 All substitutions or alternate fixtures to those indicated on the project fixture schedule shall be submitted for approval (7) business days prior to the project bid date. Approvals when accepted will be issued in the form of an addendum. No consideration for substitutions will be provided after the award of the contract.
 - 1.4.1 The substitution request must include a statement indicating the difference in price of both the specified and alternate product, both contractor and list price. The substitution request must include a comparison of the total fixture wattage, total fixture lumens, fixture efficiency and warranty comparison.
 - 1.4.2 When proposing to substitute lighting fixture and/or fixture retrofit, a point by point photometric calculation of a typical application as used in

this project shall be included. A calculation of the specified and the proposed alternate shall be included.

PART 2 – PRODUCTS

- 2.1 All catalog numbers are given for manufacturer's identification and shall not relieve Contractor from responsibility of full conformance to all applicable written description requirements governing material and fabrication, either in the general or specific sections. Where catalog numbers are indicated as modified, no modification will be required if the standard unit fully conforms to descriptive requirements in the Specifications and matches specified ceiling.
- 2.2 All fixtures of the same type shall be of one manufacturer and of identical finish and appearance. All fixtures and component parts shall bear the UL label.
- 2.3 All steel parts shall be phosphate treated in multistage power spray system for corrosion resistance and paint adhesion. Final finish shall be electrostatically applied baked white enamel of not less than 87 pct. reflectance on reflecting surfaces.
- 2.4 Each fixture shall have a continuous light-seal gasket seated in such manner as to prevent any light leak through any portion or around any edge of the trim frame.
- 2.5 Diffusers shall be framed in a hinged, continuous assembly. Diffuser frame latches shall be spring-loaded or cam-operated.
- 2.6 All recessed fixtures shall be provided with frames appropriate for the type of ceiling involved. No fixtures shall be ordered until the ceiling construction has been verified by the Contractor.

MINIMUM LUMINARY REQUIREMENTS

- 2.7 Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70 by a qualified testing agency and marked for intended location and application.
- 2.8 Recessed Fixtures: Comply with NEMA LE 4.
- 2.9 CRI of **minimum 80 CCT of 4100 K.**
- 2.10 Rated lamp life of 50,000 hours minimum.
- 2.11 Lamps dimmable from 100 percent to 0 percent of maximum light output.
- 2.12 Nominal Operating Voltage: **120V/ 277 VAC**

PART 3 – EXECUTION

- 3.1 All lighting fixtures shall be supported as follows:

- 3.1.1 From the outlet box by means of a metal strap where its weight is less than five pounds.
- 3.1.2 From its outlet box by means of a hickey or other threaded connection where its weight is from five to fifty pounds.
- 3.1.3 Directly from the structural slab or joists where its weight exceeds fifty pounds.
- 3.1.4 Lighting fixtures shall be supported independent of the ceiling system or additional ceiling support must be added to carry the weight of the lighting fixtures. Recessed lighting fixtures supported from ceiling grid tees shall be furnished with hold down clips in conformance with CEC 410 - 16, spring clips will not be permitted. All fixtures which the manufacturer has not provided UL approved clips, must be attached to the fixture and ceiling grid by metal screws.
- 3.2 Furnish and install supplementary blocking and support as required to support fixture from structural members. Contractor shall submit proposed blocking method for all suspended lighting fixtures for approval prior to rough in.
- 3.3 Suspended and/or pendant mounted fixtures shall be provided with four aircraft safety cables extending in opposite directions, attached to the fixture, and supported from a structural member. The contractor shall submit proposed fixture mounting and aircraft cable attachment methods for approval prior to fixture rough in.
- 3.4 Class 1 wiring to the fixture must be installed either conduit or type MC-PCS cabling no open wiring shall be permitted.
- 3.5 Chain suspension may be used only where specifically permitted on the drawings. Chain shall be heavy duty, nickel or cadmium plated, suitable for weight of specific fixture.
- 3.6 Shop drawings shall be furnished for each fixture type. Catalog cuts, illustrating conformance with specifications, will be acceptable for standard units. Shop drawings shall indicate materials, assembly, finish and dimensions.
- 3.7 Photometric data shall be furnished for any fixture substituted for those listed on the schedule.
- 3.8 Any driver which produces a greater than normal amount of noise shall be replaced by the contractor. Normal will be determined by the level of sound produced by other similar fixtures operating in the area.

END OF SECTION 265114

SECTION 269090 – ELECTRICAL CLOSEOUT

PART 1 – GENERAL

- 1.1 Upon completion of the electrical work, the entire installation shall be tested by the Contractor, and demonstrated to be operating satisfactorily to the Architect, Engineer, Inspector and Owner.
- 1.2 All testing and corrections shall be made prior to demonstration of operation to the Architect, Engineer, Inspector and Owner.
- 1.3 In addition to the demonstration of operation, the Contractor is also required to review the content and quality of instructions provided on items demonstrated with the Architect, Engineer, Inspector and Owner.

PART 2 – EXECUTION

- 2.1 Wiring shall be tested for continuity, short circuits and/or accidental grounds. All systems shall be entirely free from “grounds,” “short circuits,” and any or all defects.
- 2.2 Motors shall be operating in proper rotations, and control devices functioning properly. Check all motor controllers to determine that properly sized overload devices are installed, and all other electrical equipment for proper operation.
- 2.3 Tests and adjustments shall be made prior to acceptance of the electrical installation by the Architect, and a certificate of inspection and acceptance of the electrical installation by local inspection authorities shall be provided.
- 2.4 All equipment or wiring provided which tests prove to be defective or operating improperly shall be corrected or replaced promptly, at no additional cost to the Owner.
- 2.5 Test all motor and feeder circuits with a “megger” tester to determine that insulation values conform to the California Electrical Code (CEC). Test reports must be submitted and approved by the engineer before final acceptance.
- 2.6 Test all grounding electrode connections to assure a resistance of no more than 10 ohms is achieved. Augment grounding until the ohmic value stated above is achieved. Provide certified test results to the Architect, Engineer and Inspector.

END OF SECTION 269090

SECTION 270100 - COMMUNICATIONS GENERAL PROVISIONS

ARTICLE 1 - SUMMARY

- 1.1 This Division of the specifications outlines the provisions of the contract work to be performed as a sub contract under the Division 26 scope of work. Reference the Division 26 Electrical General Provisions for scope of work and general requirements.
- 1.2 In addition, work in this Division is governed by the provisions of the bidding requirements, contract forms, general conditions and all sections under Division 1 requirements.

END OF SECTION

SECTION 271000 - VOICE / DATA INFRASTRUCTURE**PART 1 – GENERAL**

- 1.1 Include all labor, equipment and materials necessary for providing a complete networking infrastructure system as described herein and/or as indicated on the drawings.
- 1.2 Related specification sections:
 - 1.2.1 Section 26 01 00 - General Provisions.
 - 1.2.2 Section 26 05 33 - Conduit and Fittings.
 - 1.2.3 Section 26 05 19 - Conductors.
 - 1.2.4 Section 26 05 34 – Outlet and Junction Boxes.
- 1.3 Approved minimum Product and Contractor Extended Warranty Certifications;
 - 1.3.1 All components shall be manufactured by one of approved manufacturers, the installing Contractor must have the accompanying certification from the product manufacturer(s) for installation of a “Extended Warranted System” as required by each manufacturer and as indicated in these specifications.
 - 1.3.1.1 Specified system warranties are to be established between the component and cable manufacturers and the District, warranties between the cable manufacturer only or installing Contractor and the District are not considered equal.
 - 1.3.1.2 Warranty shall be a full “Performance Warranty” installed by a “Certified Contractor” as specified by one of the approved manufacturers. A “Component Warranty” will not be considered equal. All components, labor, and “Performance Criteria” shall be warranted by one of the approved manufacturers;
- 1.4 Acceptable manufacturers are:
 - 1.4.1 **Leviton / Berk-Tek**
 - 1.4.1.1 Installing Contractor must be LEVITON Network Solutions Premier certified to install this system.
 - 1.4.1.2 Warranty provision and training must be for the Leviton/Berk-Tek – Limited Lifetime Premium Performance Warranty program.
 - 1.4.2 **Commscope**
 - 1.4.2.1 Commscope’s Training and Warranty programs encompass the brand names known as Uniprise.

1.4.2.2 Installing Contractor must be PartnerPro certified to install any of the systems under the Commscope Family of brand names.

1.4.2.3 Warranty provision and training must be for the Commscope (Netconnect, Uniprise and Systimax) – 25-Year Premium Performance Warranty program.

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1.4.3 Belden

1.4.3.1 Belden's Training and Warranty programs.

1.4.3.2 Installing Contractor must be certified Belden PartnerAlliance Networking Installers.

1.4.3.3 Warranty provision and training must be for the Lifetime Application Assurance Program apply only to Belden Certified Networking Systems installed by the Certified PartnerAlliance.

1.4.4 Panduit/General Cable

1.4.4.1 Installing Contractor must be PanGen certified to install this system.

1.4.4.2 Warranty provision and training must be for the PanGen Certification Plus – 25-Year Siemon Premium Performance program.

1.4.5 Warranty shall be to the District, for the period as defined by the Network Infrastructure System selected for installation, after District acceptance and sign-off of the completed system. The Contractor must provide documentation from one of the approved manufacturers, as indicated in Section 1.3, indicating their qualifications for installation of this system in compliance with the manufacturer's warranty period requirements as a warranted Contractor.

1.4.6 Equipment qualifications: It is the intent of these specifications that each bidder provides all hardware, components and installation services that are necessary to ensure a fully operational wiring system including warranties, as shown in the EIA/TIA Category-6 and the Augmented Category-6 (6A) guidelines.

1.4.7 All components, parts, infrastructure, patch cables, termination panels and cables must be classified by the manufacturer or manufacturers as a part of the "Extended Warranty" program. Contractor may not mix in components from other certified programs or materials that are not considered part of the "Lifetime" warranty.

1.4.8 Systems or components as manufactured by any other manufacturer which, are not specifically listed in 1.3, are **not** approved for use on this project.

1.5 Installing Contractor qualifications: Firms and their personnel must be regularly engaged in the installation of data networking cabling and equipment for systems of similar type and scope. The Contractor must have a full-service office able to respond to

emergency callouts during the warranty period. The Contractor must also provide complete installation of all wiring and devices or equipment. **Subcontracts with Electrical Contractors or other warranted or non-warranted Contractors for supervised installation of any part of this system are not approved.**

- 1.5.1 Contractor shall have on staff a minimum of (1) BICSI RCDD on staff as full-time employees.
- 1.5.2 The successful Contractor shall be a California licensed C7 or C10 Premise Wiring Contractor as defined in this specification.
- 1.5.3 All work shall be performed under the supervision of a company accredited and trained by the Manufacturer of the components and cable and such accreditation must be presented with the bid submittal. Contractor must be accredited a minimum of 180 days prior to bid submittal date. All personnel performing work on this project must have successfully completed the manufacturer's training courses to completely comply with the extended warranty requirements prior to performance of any work on this project. Accreditation will consist of individual employee certifications issued by the manufacturer or manufacturers.
- 1.5.4 All personnel engaged in the testing of premises fiber optic and copper UTP cable systems must have successfully completed the test equipment manufacturer's training courses. Certification of such training must be presented with the bid submittal. Cut sheets of the test equipment to be utilized shall be provided with the Phase I project material submittals.
- 1.5.5 This project shall employ both Category-6 and Augmented Category-6 cabling. The Contractor shall install the related components in relation to the performance requirements for each type of cable installed.
- 1.5.6 If Contractor routes cables and/or associated pathways in another route than indicated on the drawings, they shall maintain all maximum cable installation distances as required by the manufacturer's distance limitations.
- 1.6 In order to ensure project cohesion, a single point of contact is required to provide a "TURNKEY" solution. The work covered under this section of the specification consists of furnishing all; labor; cabling; equipment; supplies; materials, and training. The Contractor will perform all operations necessary for the "TURNKEY" and fully completed installation in accordance with the specifications herein. As such, the successful Contractor must be factory trained on all aspects of Network Infrastructure Cabling System.
- 1.7 The drawings indicate a schematic routing of cables above ceilings. The Contractor shall field-verify the most appropriate routing of all above-ceiling cable prior to bid. Where cables penetrate through walls a conduit sleeve shall be provided. Where cables pass through fire rated walls, the conduit sleeve shall be sealed to maintain the rating of the wall assembly.

- 1.8 Unless otherwise noted in the project drawings or these specifications, the Division 26 Contractor shall provide the installation of all conduits, outlet and junction boxes, trenching and pull box installation.
- 1.9 The Contractor shall provide a licensed, qualified electrical Contractor for installation of all conduits, outlet and junction boxes, trenching and pull box installations.
- 1.10 General Submittal Requirements
 - 1.10.1 **Phase I Submittal** shall be made in electronic format within (20) working days after the award of the contract by the District. This submittal shall include the following:
 - 1.10.1.1 Complete Bill of Materials in Excel Spreadsheet format with bills of quantities, including all materials, components, devices, and equipment required for the work. The bills of quantities shall be tabulated respective of each and every system as specified, and shall contain the following information for each Section listed:
 - 1.10.1.2 Description and quantity of each product.
 - 1.10.1.3 Manufacturer's Name and Model Number.
 - 1.10.1.4 Material Cut Sheets shall provide detailed product information and shall be original manufacturer product bulletins. Copies of material information from vendor websites shall not be considered equal and will not be accepted.
 - 1.10.1.5 Material Cut Sheet part number provided shall be highlighted or provided with an arrow directed at the corresponding part number.
 - 1.10.1.6 Specification Item Number referenced for each required product or if not shown in the specifications, Drawing Detail Number being referenced. (ie; Spec. 271000 Item 2.1 or DWG E4.15/#1)
 - 1.10.1.7 Include with submittals all warranty information and a description of support and maintenance services to be provided. Also include all licenses and maintenance agreements required for continued operation of the equipment.
 - 1.10.2 **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 in a CAD Software. Submission shall include electronic print copies to match the contract drawings, and Phase II submittals drawings shall include the following.
 - 1.10.2.1 MDF and IDF equipment rack or cabinet elevations will be required to be provided including cable routing, grounding, support, UPS,

network electronics, etc. and position of all components in the rack or cabinet.

1.10.2.2 Provide labeling plan which identifies the proposed scheme for identifying all components including Racks, patch panels (fiber and copper), site distribution feed cables, horizontal station cables and site conduit systems (handholes, pullboxes, etc.).

1.10.2.3 Provide shop drawings showing all end device locations, tap values, paging zones and amplifier sizing for each zone for analog speakers and horns, including devices connected to IP-Based zone controllers.

1.10.3 Common submittal mistakes which will result in submittals being rejected:

1.10.3.1 Not including the qualifications of the installing Contractor Company and Contractor's Staff.

1.10.3.2 Not including all items listed in the above itemized description.

1.10.3.3 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed (provided for the project) or crossing out the items which are not applicable.

1.10.3.4 Not including actual manufacturer's cut sheets or catalog information of proposed products.

1.10.3.5 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

1.10.4 The Contractor shall make a written request directly to Johnson Consulting Engineers for electronic drawing files (CAD). As a part of the written request, please include the following information:

1.10.4.1 Clearly indicate Project Name and Client, Johnson Consulting Job Number (located in bottom left corner of JCE Engineering Stamp) and each drawing Sheet Number required (i.e., E1.1, E2.1, E4.1 etc.).

1.10.4.2 Identify the name, Company, Title, phone number, mailing address and e-mail address of the person to receive the files.

1.10.4.3 Detail or Riser diagram sheets, System Schematic drawings or any other drawings other than floor plans or site plans, will not be made available to the Contractor.

1.10.4.4 Files will only be provided in the AutoCAD format in which they were created (i.e., version 2015 or version 2016). Files will not be made available in REVIT format.

1.10.5 Requests for files will be processed as soon as possible; a minimum of 7 working days should be the normal processing time. The Contractor shall be completely responsible for requesting the files in time for their use and delays in requesting files will not alleviate the Contractor from submitting required documents within the required timeline.

PART 2 – RACKS AND CABINETS

2.1 Equipment racks have been detailed on the drawings and additional component information requirements have been described in the MDF or IDF products sections. The following is a list of approved manufacturers for each type of rack to be furnished.

2.1.1 Alternate equipment manufacturers other than those indicated will not be reviewed or approved for use on this project.

2.1.2 **(Open Frame – 4-Post)** shall be manufactured by Chatsworth CPI QuadraRack or Middle Atlantic R4 Series. Reference drawing details and specifications for complete requirements.

PART 3 – MDF ROOM REQUIREMENTS

Main Distribution Frame (MDF is existing in the Administration Building – ‘MDF-F’)

3.1 The Main Distribution Frame (MDF) Room is existing. The Contractor shall include the following items at this location;

3.1.1 Provide all accessories required whether shown on the project drawings or within these specifications. The drawings and specifications shall be considered a single document.

3.1.2 The existing MDF is a stand-alone full height cabinet. Contractor shall dress and provide all ties for management of the new fiber optic cable entering the cabinet. Do not disconnect any existing equipment or terminations.

3.1.3 Fiber Optic Feed Cable Patch Panels - Fiber optic termination equipment (rack mounted), including all associated installation hardware. The equipment must have sufficient number of ports to connect all fibers in every cable terminated at this location. Provide 25% spare capacity for future wiring requirements, including bulkheads in the fiber patch panel. Provide blank fillers for all used portions of the panel. All fiber feed cables shall be terminated in a single fiber optic patch panel up to 144 strands. Additional strands shall be terminated in the largest size required to contain the remaining fibers.

3.1.3.1 Contractor shall provide a minimum of 6-feet of slack on the fiber feed cable in the fiber optic patch panel. The first 48” of a tight

buffered cable or the first 24” of a loose tube cable shall not be stripped back in the patch panel. Each type of cable shall have a minimum of 24” of stripped slack within the patch panel. Total slack within the patch panel shall not be less than 6-feet in length.

- 3.1.3.2 All fiber cables shall be secured to the patch panel with the Kevlar strength members at the manufacturer provided anchor point at the rear of the panel.
- 3.1.3.3 The contractor shall rearrange the existing patch panels and wire management as required to fit the new fiber optic patch panel in the existing MDF Cabinet.

Additional items required for each MDF are as follows:

- 3.1.4 Changes/Updates to the MDF Room – Contractor shall provide the following items in the existing MDF Room: Terminate new fiber optic feed cabling in the existing MDF racks. Provide new fiber optic patch panel and service loop manager in the MDF Room. Provide all other requirements associated with the provision of new fiber feed cabling. The remainder of the MDF Room shall remain as-is. See details and drawings for additional installation requirements.
- 3.1.5 Refer to the detail drawings and specifications for the termination requirements at the MDF and IDF locations
- 3.1.6 All fiber optic feed cables routed to the MDF Room shall be provided with 20-feet of slack for a service loop stored above the existing MDF Cabinet. Contractor shall provide a 24” diameter service loop manager for the fiber optic feed cables as manufactured by Leviton #48900-FR mounted in the ceiling above the existing MDF Cabinet. Maximum of (3) fiber feed cables per manager. Provide quantity of managers as required to manage all service loops
- 3.1.7 Provide all other items as detailed on the drawings.

PART 4 – IDF REQUIREMENTS

Intermediate Distribution Frame (IDF) Typical Requirements

- 4.1 The Intermediate Distribution Frame (IDF) Room shall be a secondary wiring and equipment location for the data networking system. The Contractor shall include the following items at this location.
 - 4.1.1 Provide backboard 8'-0" high x 3/4" thick, with a minimum 48” width. Refer to the floorplans for the actual layout of the backboard coverage. Plywood mounting backboard shall be flame resistant, painted with fire resistant paint “white” or color to match the room finish. Contractor shall provide minimum one side finish grade plywood. Backboard shall be mounted with finish side out, regardless of location of fire rating stamp. Show proof of fire rating stamp to IOR or Inspector prior to installation.

- 4.1.2 Fiber Optic Feed Cable Patch Panels - Fiber optic termination equipment (rack mounted), including all associated installation hardware. The equipment must have sufficient number of ports to connect all fibers in every cable terminated at this location. Provide 25% spare capacity for future wiring requirements. Provide blank fillers for all used portions of the panel. All fiber feed cables shall be terminated in a single fiber optic patch panel.
- 4.1.2.1 IDF location shall be furnished with a minimum 24-Port patch panel, fully loaded with bulkheads. Type of connectors in the bulkheads shall be determined by the type of connectors used for termination of the fiber feed cables.
- 4.1.2.2 Contractor shall provide a minimum of 6-feet of slack on the fiber feed cable in the fiber optic patch panel. The first 48" of a tight buffered cable or the first 24" of a loose tube cable shall not be stripped back in the patch panel. Each type of cable shall have a minimum of 24" of stripped slack within the patch panel. Total slack within the patch panel shall not be less than 6-feet in length.
- 4.1.2.3 All fiber cables shall be secured to the patch panel with the Kevlar strength members at the manufacturer provided anchor point at the rear of the panel.
- 4.1.3 Category-6 Modular Patch Panels (rack mounted) with RJ45 style connectors, for terminating all twisted pair cable from each Voice/Data, AV Equipment and IP Camera outlet, served from this location. Provide a minimum of 25% spare capacity for future wiring requirements. All patch panels shall be 48-Ports only, 24-Port patch panels shall not be accepted. Provide cable support bars at the rear of each patch panel all cables shall be secured to bars with velcro straps.
- 4.1.4 Augmented Category-6 Patch Panels (rack mounted) with RJ45 style connectors, for terminating all twisted pair cable from each WAP outlet served from this location. Provide a minimum of 25% spare capacity for future wiring requirements. All patch panels shall be 48-Ports only, 24-Port patch panels shall not be accepted. Provide cable support bars at the rear of each patch panel all cables shall be secured to bars with velcro straps.
- 4.1.5 If the project requires the installation of both Category-6 and Augmented Category-6 cabling and patch panel connections, the Augmented Category-6 patch panel shall be clearly labeled as "Augmented Category-6" and the RJ45 port connections shall be either a different color than the standard Category-6 patch panel ports, or the patch panel ports shall be provided with a colored icon to differentiate the Augmented Cat-6 connections from the Category-6 connections. **All patch panels shall be provided fully loaded with RJ45 style connectors.**
- 4.1.6 Uninterruptible Power Supplies (UPS) shall be furnished and installed by the District. Contractor shall furnish the required power outlet for the UPS at the IDF location. See the floor plans for the power requirements.

- 4.2 IDF Room shall be provided with 4-Post Racks - Furnish and install equipment mounting racks as shown on project floor plans and details. Furnish the following additional components and installation practices for the racks;
- 4.2.1 Provide all accessories required whether shown on the project drawings or within these specifications. The drawings and specifications shall be considered a single document.
 - 4.2.2 The racks shall be provided with structural seismic bracing using cable runway to the top of the rack, with the width of runway as shown on the MDF Room drawings and details.
 - 4.2.3 Universal 12" cable runway shall be as manufactured by CPI Model 10250-712. The cable runway shall be furnished with the additional adapters, connectors, support components, bends and offsets and extensions as required to fit the room and layout as shown in the drawings. Cable runway shall be bonded together as shown in the detail drawings.
 - 4.2.4 Anchor the cable runway to the wall with the appropriate width angle bracket and bolts as manufactured by CPI Model #11421-712.
 - 4.2.5 The cable runway shall also be attached to the top of the rack with the appropriate adapter panel. Cable runway shall be directly attached to the 4-Post racks with J-Hooks.
 - 4.2.6 Cable runway routed along walls, shall be offset from the wall a minimum of 6" and shall be supported with cantilevered wall mount brackets as shown in the detail drawings.
 - 4.2.7 The racks shall be structurally anchored to the floor with the anchors and bolts as shown in the detail drawings. Anchoring shall comply with all Local, State and National Codes.
 - 4.2.8 Provide Standard 4-Post Racks, 19" mounting width by 84" High by 29" Deep with #12-24 mounting holes as shown in the IDF Room layout and details. See detail drawings for quantity of racks and additional requirements. Contractor shall be responsible for providing all racks and accessories as shown in the details. The 4-Post racks shall be as manufactured by CPI Model #50120-703 or approved equal by Middle Atlantic.
 - 4.2.9 Provide (1) adjustable full depth vented shelf for each 4-Post equipment rack as manufactured by CPI #16350-719.
 - 4.2.10 Provide full length vertical wire managers, CPI Double-Sided Narrow Vertical Manager, Part #12096-703, on each side of each rack. Vertical managers between racks may be substituted with the CPI #11729-703 6" wide double-sided manager. Single narrow vertical managers shall be provided on each end of the group of racks.

- 4.2.11 Provide horizontal wire managers between each patch panel or (1) manager per patch panel. Provide (1) spare manager per rack. Provide 2RMU height managers for each 48-Port patch panel and 1RMU height managers for 24-Port patch panels. CPI Part #30130- 719 and # 30139-719.
- 4.2.12 Provide (1) ground bus bar kit with lugs per IDF Room as detailed in the drawings. Ground Bus Bar kit as manufactured by CPI #40158-012 (or approved equal). Ground Bus Bar and all bonding conductors to the bus bar shall be labeled as shown in the drawing details. Grounding conductors shall be routed to the equipment racks, cable runway and electrical panel.
- 4.2.13 Furnish grounding to each rack as shown in the detail drawings. Each rack shall be provided with a grounding terminal block, #6 Ground wire from the rack to the busbar and a compression lug on the end of the ground wire at the busbar. Provide grounding components as manufactured by CPI #40167-001 terminal block and #40162-901 compression lug or approved equal.
- 4.2.14 All fiber optic feed cables routed to the IDF Room shall be provided with 20-feet of slack for a service loop mounted on the backboard behind the racks. Contractor shall provide a 24" diameter wall mounted service loop manager for the fiber optic feed cables as manufactured by Leviton #48900-FR. Maximum of (3) fiber feed cables per manager. Provide quantity of managers as required to manage all service loops.
- 4.2.15 All cable runway, racks, accessories, supports and wire management shall be black in color. (Unless Otherwise Noted)
- 4.2.16 Provide all other items as detailed on the drawings.

PART 5 – MDF/IDF PATCH CORD REQUIREMENTS

5.1 Fiber Optic Patch Cords

- 5.1.1 Fiber optic patch cords shall be furnished and installed by the Contractor.
- 5.1.2 All fiber optic patch cords furnished by the Contractor shall match the grade and glass of the fiber optic feed cable installed for the network infrastructure cabling system. The Contractor shall confirm with the District IT Department the type of connector required at the network equipment prior to ordering or installing the patch cords.
- 5.1.3 Multimode Fiber Optic Patch Cords - Patch cords shall be duplex 50/125um, laser-optimized, OM4 grade multimode optical glass. Fiber optic patch cords shall be furnished with LC connectors at the network switch port end and LC connectors at the fiber optic patch panel end. Fiber patch cords shall be furnished with ceramic ferrules. All Multimode patch cords shall be Aqua (Lt. Blue) in color. Patch cords shall be 3-feet (1 meter) in length.

- 5.1.4 Single Mode Fiber Optic Patch Cords - Patch cords shall be duplex 8.3/125um, (OS2) grade single mode optical glass. Fiber optic patch cords shall be furnished with LC connectors at the network switch port end and LC connectors at the fiber optic patch panel end. All Single Mode patch cords shall be Blue in color. Patch cords shall be 3-feet (1 meter) in length. If the single mode fiber is directed to be stored for future use, the single mode patch cords will not be required. Refer to the new fiber optic feed cable section for instructions on termination of the new single mode fiber feed runs.
- 5.1.5 Each fiber optic feed cable from the MDF Room to the IDF location requires (2) duplex fiber optic patch cords for connection to the IDF switch. Contractor shall furnish (2) Multimode fiber patch cords for each fiber optic feed cable terminated in the MDF Room patch panels. Contractor shall be responsible for confirming the network switch connections with the District IT Director prior to ordering or installing the patch cords.

5.2 Copper Patch Cords

- 5.2.1 Copper patch cords shall be furnished and installed by the Contractor.
- 5.2.2 Provide Enhanced Category-6 rated (Patch Panel End) patch cords with pre-molded boot, provide quantity equal to:
 - 5.2.2.1 Provide 100% of the total Enhanced Category-6 rated cable ports provided on the patch panels.
 - 5.2.2.2 All patch cords to be installed by Contractor. Provide 100% of total copper patch cords required to be (2) feet in length.
- 5.2.3 Provide Enhanced Category-6 rated (Workstation End) patch cords with pre-molded boot, provide quantity equal to:
 - 5.2.3.1 Provide 100% of the total Enhanced Category-6 rated cable ports provided on the patch panels.
 - 5.2.3.2 All patch cords to be installed by Contractor. Provide 100% of total copper patch cords required for voice and data locations, to be (10) feet in length, unless otherwise noted.
 - 5.2.3.3 All patch cords to be installed by Contractor. Provide 100% of total copper patch cords required for IP Camera and AV Equipment locations, to be (2) feet in length, unless otherwise noted.
- 5.2.4 Provide Augmented Category-6 (Patch Panel End) patch cords with pre-molded boot, provide quantity equal to:
 - 5.2.4.1 Provide 100% of the total Category-6A cable ports provided on the patch panels.

- 5.2.4.2 All patch cords to be installed by Contractor. Provide 100% of total copper patch cords required to be (2) feet in length.
- 5.2.4.3 Augmented Category-6 patch cords shall be differentiated from the Category-6 patch cords with a different color jacket.
- 5.2.5 Provide Augmented Category-6 (Workstation End) patch cords with pre-molded boot, provide quantity equal to:
 - 5.2.5.1 Provide 100% of the total Category-6A cable drops provided on the patch panels.
 - 5.2.5.2 Patch cords installed at WAP (Wireless Access Point) locations shall be (2) feet in length.
 - 5.2.5.3 Augmented Category-6 patch cords shall be differentiated from the Category-6 patch cords with a different color jacket.
- 5.2.6 Requirements for all copper patch cords furnished:
 - 5.2.6.1 Color of patch cords shall be determined by the color codes shown in the drawing details or as otherwise directed by the District IT Department.
 - 5.2.6.2 Patch cords shall be as manufactured by Leviton, Commscope, Panduit or Ortronics based on the network infrastructure system furnished by the Contractor.
 - 5.2.6.3 Definition of “Enhanced Category-6 Rated” patch cables – Since there is no official EIA/TIA rating level determined to be “Enhanced Category-6”, the provision of any cables shall be based on the manufacturer’s performance claims for the product.
 - 5.2.6.4 Patch cords furnished must be in compliance with the manufacturer’s “Channel” warranty requirements. Patch cords not warranted through the selected manufacturer Channel warranty program will not be approved for use with the network infrastructure.

PART 6 – CABLING REQUIREMENTS

6.1 Campus Fiber Optic Feed Cable Requirements

- 6.1.1 Provide one continuous fiber optic cable routed from the Main Distribution Frame fiber patch panel to each Intermediate Distribution Frame fiber patch panel, and/or other locations as shown on the drawings.
- 6.1.2 For new Fiber Optic Feed Cables shown on the drawings and in the specifications; Fiber optic feed cables shall be installed in the existing pathways, unless otherwise shown on the drawings. Contractor shall not interrupt service to

the users without a planned outage approved by the District. The Contractor may use the existing feed cable as a pull wire or other cables identified to be removed from the existing conduits, provided that the service is back on-line prior to the user's normal working hours.

6.1.3 Provide (1) fiber optic feed cable to the New Classroom Building IDF location from the campus MDF location as designated in the drawings and specifications. The cable shall contain all of the quantities and types of fibers required in the drawings and specifications.

6.1.4 Outdoor Fiber Feed Cable Applications - Fiber optic cable shall be rated for indoor/outdoor riser rated applications. Construction shall consist of; all dielectric, indoor/outdoor Riser Rated Tight Buffer Style, flame retardant PVC or PE jacket, rated OFNR, Outer and Inner Layer of Dielectric Strength Yarns with central member constructed of Dielectric Strength Yarns, dry water-blocking compound, and blank fillers as required. Fiber shall be small form factor type fiber for use in existing conduit and pathways and **shall not exceed an Overall Outside Diameter (OD) of .370"**. Central tube or loose tube type fiber will not be considered equal.

6.1.5 Fiber optic feed cables for the data infrastructure must be installed as follows:

6.1.5.1 Composite Fiber Optic feed cable run – Fiber optic feed cable containing both Multimode and Single Mode strands shall be installed as a single composite feed cable. Provide a total of 24-strands of fiber, with 12-strands of OM4-Rated Multimode and 12-strands of OS2-Rated Single Mode glass to the IDF location, unless otherwise directed in the drawings or specifications. Do not provide separate fiber optic cables for each type of fiber to the IDF location. Feed cables shall be clearly defined and labeled at each junction box or handhole.

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6.1.6 Designated Parking Lot Light Poles shall be provided with a 4-Strand, 50/125um, "OM4" Multimode, OSP, tight buffer fiber optic cable. The cable shall be Indoor/Outdoor Riser-Rated 4-Strand Belden #FD4D004R9 (or equal by one of the approved manufacturers).

6.1.6.1 Contractor shall confirm the distance to the camera locations prior to the ordering or installation of the fiber optic station cabling. Provide the distance for each cable run to the Project Engineer prior to the installation of any cabling.

6.1.6.2 The cable shall be terminated at both ends with "LC" type connectors. All fibers shall be terminated. Fiber optic cable shall be terminated at the light pole junction box using the Belden KeyConnect Duplex "LC" OM4 insert adapter #AX105641 for the surface mount box. (or equal by one of the approved manufacturers). The insert adapter shall be "Erika Violet" in color.

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- 6.1.6.3 Provide a separate fiber optic patch panel in the IDF Room equipment rack for the fiber optic station cable runs to the cameras. Route the fiber to the fiber optic patch panel in the equipment rack and provide “LC” OM4 Multimode connector panels to accommodate all strands. Provide a minimum of 25% spare capacity for the fiber optic patch panel for future use.
 - 6.1.6.4 The fiber-optic cables shall be terminated at the exterior camera locations on the light poles on a Belden KeyConnect Side-Entry on a four-port #AX105354-XX (XX=Color) surface mount box. (or equal by one of the approved manufacturers). The surface mount box shall be installed inside the Base Junction Box on the light pole. The surface mount box must be installed to fit inside the junction box with the Power Outlet, Power Supply and Ruggedized Ethernet Switch, where required. Refer to the drawing details for additional requirements. Provide a 10-foot service loop in the junction box in the base of the light pole.
 - 6.1.6.5 Coordinate installation with the Section 28 23 00 Contractor for space inside the Light Pole Base J-Box and installation of all the components inside the J-Box.
- 6.1.7 Feed cables shall be clearly defined and labeled for each system. Provide color coding designations with a different color marker for the multimode and/or single mode fiber feed terminations in the fiber patch panels.
- 6.1.8 Additional labeling on the fiber optic patch panel is required to identify which type of fiber is terminated on the bulkheads in the panel. All connectors and bulkheads shall be color coded with Aqua for 50/125um Multimode and Blue for Single Mode fiber types.
- 6.1.9 Each fiber optic feed cable shall contain one or all types of the fiber optic glass listed below:
- 6.1.9.1 Provide Multimode 50/125-micron fiber optic glass, (minimum OM4 laser-optimized grade) for dual mode operation at 850 nm and 1300 nm wave lengths.
 - 6.1.9.1.1 Maximum attenuation at 3.5dB/km @ 850nm and 1.5dB/km @ 1300nm. Minimum 1-gigabit Ethernet distance guarantee of 1040 meters @ 850nm and 600 meters @ 1300nm. Minimum 10-gigabit Ethernet distance guarantee of 550 meters @ 850nm and 300 meters @ 1300nm. Fiber shall be ISO-TIA OM4 rated.
 - 6.1.9.2 Single mode 8.3/125-micron fiber optic glass, (minimum OS2) High Performance grade for dual mode operation at 1310 nm and 1550 nm wave lengths.

6.1.9.2.1 Maximum attenuation at 0.7dB/km @ 1310nm and 0.7dB/km @ 1550nm. Quantity of fibers as per detail drawings.

6.1.10 All fibers in the fiber optic feed cable shall be fully operational within the required performance characteristics as published by the manufacturer. If any individual fiber does not meet the minimum standards, the entire cable must be replaced, end to end, including connectors, without any additional expense to the customer.

6.1.11 All fiber optic strands shall be fully terminated and tested, unless otherwise noted in the drawings or in these specifications.

6.1.12 Refer to drawings for cable types required. Refer to acceptable cables section for additional information and approved manufacturers.

6.1.13 Acceptable cables shall be:

6.1.13.1 Berk-Tek Multimode — GIGALITE 10-FB-OM4

6.1.13.2 Berk-Tek Single Mode — Enhanced OS2 Single Mode -AB

6.1.13.3 Commscope Multimode — (All Brand Names) Systimax LazrSpeed 550 OM4

6.1.13.4 Commscope Single Mode — (All Brand Names) Systimax TeraSpeed OS2

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6.1.13.5 Belden Multimode OM4 Grade — “FD4D” OM4 Systems

6.1.13.6 Belden Single Mode OS2 Grade — “FDSD” OS2 Systems

6.1.13.7 General Cable Multimode — Clear Curve OM4 (Type BL)

6.1.13.8 General Cable Single Mode — SMF-28 Ultra Enhanced OS2 (Type Ax)

6.1.13.9 (Note; General Cable use Corning glass and Corning descriptions)

Above glass types are an example of product names per manufacturer. Confirm requirements for indoor/outdoor and riser rated fiber cable with riser drawings and site plans. Part numbers for composite style cable will vary greatly. Confirm part numbers with manufacturer.

6.2 Category-6 Station Cable

- 6.2.1 Contractor shall provide a Category-6 UTP cable to each Data, Voice, Audio-Visual Data and IP Camera indicated on the drawings and specifications. Provide quantity of cables as indicated on the drawings at each location.
- 6.2.2 Provide one Category-6, 4-pair, unshielded twisted pair (UTP) cable from the nearest MDF or IDF location to each RJ45 data outlet port indicated on the drawings. Dual port outlets will require two such cables. Four port outlets will require four cables. Refer to the drawing details for jacket color requirements for each type of connection. Color of cable jacket for each type of connection shall be determined by the drawing details. Confirm color of cable jackets prior to ordering with the District IT Director. Contractor shall be responsible for providing the correct jacket color per the drawings per District Standards.
- 6.2.3 Unless otherwise shown in drawing details, the color of the Category 6 UTP cables shall be blue, shall be copper wire, individually insulated and color coded.
- 6.2.4 The cables shall be UL or ETL rated and UL verified in compliance Category-6 EIA/TIA standards. Approved cables for Network Infrastructure System;



6.2.4.1 Commscope (Uniprise) — CS37R

6.2.4.2 Belden — 2412

6.2.4.3 Berk-Tek — LANMARK 2000 – 10167477

6.2.4.4 General Cable — GigaSpeed 6500 71339XX

- 6.2.5 Manufacturer names and part numbers are shown as a point of reference and do not specifically designate required packaging or color for the cable. Contractor shall verify colors and packaging options shall be determined by Contractor preferences.
- 6.2.6 Definition of “Enhanced Category-6 Rated” cable – Since there is no official EIA/TIA rating level determined to be “Enhanced Category-6”, the provision of any cable shall be based on the manufacturer’s performance claims for the product.

6.3 Augmented Category-6 Station Cable

- 6.3.1 Contractor shall provide an Augmented Category-6 UTP cable to each Wireless Access Point location indicated on the drawings and specifications. Provide quantity of cables as indicated on the drawings at each location.
- 6.3.2 The new Augmented Category-6 UTP cables will replace the existing Category-6 UTP cabling to each of the existing Wireless Access Point locations. Terminate the new cables at the existing WAP location and reconnect the WAP to the new cable infrastructure.

- 6.3.3 Provide one Augmented Category-6, 4-pair, unshielded twisted pair (UTP) cable from the nearest MDF or IDF location to each RJ45 data outlet port indicated on the drawings. Dual port outlets will require two such cables. Four port outlets will require four cables. Refer to the drawing details for jacket color requirements for each type of connection. Color of cable jacket for each type of connection shall be determined by the drawing details. Confirm color of cable jackets prior to ordering with the District IT Director. Contractor shall be responsible for providing the correct jacket color per the drawings per District Standards.
- 6.3.4 Unless otherwise shown in drawing details, the color of the Augmented Category 6 UTP cables shall be blue, shall be copper wire, individually insulated and color coded.
- 6.3.5 The cables shall be UL or ETL rated and UL verified in compliance with Augmented Category-6 EIA/TIA standards. Approved cables for Network Infrastructure System;



6.3.5.1 Commscope (Uniprise) — CS44R

6.3.5.2 Belden — 10GXS12

6.3.5.3 Berk-Tek — LANMARK 10G2 – 10137700 (Part Number for different color jackets for Berk-Tek cable varies)

6.3.5.4 General Cable — GenSpeed 10,000 71338XX

- 6.3.6 Manufacturer names and part numbers are shown as a point of reference and do not specifically designate required packaging or color for the cable. Contractor shall verify colors and packaging options shall be determined by Contractor preferences.

6.4 Category-6 Outlets

- 6.4.1 Unshielded twisted pair Category-6 outlets shall be an RJ45 Enhanced performance type 8-position / 8 conductor modular jacks, and shall comply with Category-6 performance requirements. Provide single port, dual port, four port or quantity as indicated on the floor plans at each outlet location. All outlets shall be wired in an EIA/TIA 568B configuration.
- 6.4.2 Provide Category-6 inserts, wired for EIA 568B. Provide installation kits for all locations furnished with Category-6 UTP cabling.
- 6.4.3 Refer to the detail drawings for color of the Category-6 outlets required. Contractor shall be responsible for confirming all color requirements prior to ordering.

6.4.4 Provide the following Category-6 UTP data connector per Network Infrastructure warranty requirements;

6.4.4.1 Leviton eXtreme Cat6+ Quick Port Series 61110-R

6.4.4.2 Uniprise (Commscope) SL 110 Series 1-1375055

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6.4.4.3 Belden Cat-6+ Keyconnect Series Jacks

6.4.4.4 Panduit MiniCom TX6 Plus Series CJ688TG

6.5 Augmented Category-6 Outlets

6.5.1 Unshielded twisted pair Augmented Category-6 outlets shall be an RJ45 Enhanced performance type 8-position / 8 conductor modular jacks, and shall comply with Augmented Category-6 performance requirements. Provide single port, dual port, four port or quantity as indicated on the floor plans at each outlet location. All outlets shall be wired in an EIA/TIA 568B configuration.

6.5.2 Provide unshielded Augmented Category-6 inserts, wired for EIA 568B. Provide unshielded installation kits for all locations furnished with Augmented Category-6 UTP cabling.

6.5.3 Refer to the detail drawings for color of the Augmented Category-6 outlets required. Contractor shall be responsible for confirming all color requirements prior to ordering.

6.5.4 Provide the following unshielded Augmented Category-6 UTP data connector per Network Infrastructure warranty requirements;

6.5.4.1 Leviton Atlas-X1 Cat-6A Series 6AUJK-R

6.5.4.2 Uniprise (Commscope) AMP Twist SL Series 1-1933476

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6.5.4.3 Belden 10GX Keyconnect Series

6.5.4.4 Panduit MiniCom TX6 Plus Series CJ688TG

6.6 Outlet Faceplates

6.6.1 Provide a two-port faceplate for all one and two port outlet locations. Provide blanks for all unused openings.

6.6.2 Provide a four-port faceplate for all three and four port outlet locations. Provide blanks for all unused openings.

6.6.3 All fax/modem locations shall be provided as single port outlets. Requirements shall be the same as a single port data outlet as shown on the Technology Legend.

- 6.6.4 For single port voice outlet locations intended for wall telephone connections, a wall telephone type faceplate with attachment studs shall be provided. The wall telephone jack shall be 8-pin, RJ45 type and use IDC wire terminations only. Provide Category-6 insert, within stainless steel wall plate faceplate. Provide faceplate from the approved manufacturers listed in the specifications.
- 6.6.5 Provide single port or dual port Surface mount small surface mounted outlet box for IP Camera data outlets in the J-Box for the camera locations. Provide surface mount box by Leviton QuickPort Series 41089-xxx or equal by one of the approved manufacturers. The location shall also be furnished with a blank weather-tight faceplate to protect the data termination until the cameras are installed.
- 6.6.6 Wireless Access Point data connections for ceiling mounted WAPs shall be terminated above the accessible ceiling at the wireless access point (WAP) location. Refer to the drawing details for additional requirements.
- 6.6.7 Wireless Access Point data connections for WAPs shall be terminated at the WAP location as shown in the drawing details. Provide surface mount box by Leviton QuickPort Series 41089-xxx or equal by one of the approved manufacturers. The data connections at the WAP locations shall be Augmented Category-6 and shall be provided in the color as shown in the drawing details. The location shall also be furnished with a blank inserts for the unused ports. Label the cables and faceplate the same as standard data outlets.
- 6.6.8 All faceplates and surface mount outlet boxes shall be furnished with label windows. All labeling shall be installed within the label window.
- 6.6.9 Confirm color of all faceplates prior to ordering. All data outlet faceplates shall have a unique sequential identification number applied to faceplate. Hand written labels are not permitted. All color schemes shall be approved by the customer prior to installation.
- 6.6.10 Colored inserts are required for this project. Refer to the detail drawings for the exact color scheme to be provided. Inserts submitted that do not follow the color and identification requirements will be rejected. Inserts installed that do not follow the color coding as shown in the detail drawings will be replaced at the Contractor's expense.
- 6.6.11 All labels will be installed under label windows. Labels adhered to the surface of the faceplate will not be accepted. Contractor must provide clear laminating type of cover material over the surface mounted labels where used.
- 6.6.12 Reference the drawings for special outlet configurations or plate requirements
- 6.6.13 All data outlet faceplates shall have a unique sequential identification number applied to faceplate. Refer to the detail drawings for labeling requirements. Hand written labels are not permitted. Faceplates, with the exception of wall telephone

outlets, shall include color coded port inserts. All color schemes shall be approved by the District prior to installation.

6.6.14 Reference the drawings for special outlet configurations or plate requirements.

PART 7 – VIDEO SURVEILLANCE REQUIREMENTS

- 7.1 Provide (2) Category-6 UTP cables from the IDF closet to each camera location. All cables installed in underground conduit shall be rated for Wet Location. The cables shall be terminated in the junction box on a surface mount box. Label the faceplates on the inside with an adhesive label so the labels won't fall off. The cameras shall be installed by the 28 23 00 Contractor. Coordinate with the 28 23 00 Contractor for the exact locations of the cameras to be installed.

PART 8 – CAMPUS IP-BASED PAGING SYSTEM REQUIREMENTS

- 8.1 The Contractor shall furnish and install the analog paging speakers and horns in the new classroom building for the IP-Based Paging System Control Software and interface devices provided by the 27 20 00 Contractor. The 27 10 00 Contractor shall install the cabling, speakers and amplifiers in the IDF Room for the system. The network connections to the paging interface devices in the IDF Room, installation and programming of the paging system software and network interface connections shall be provided by the 27 20 00 Contractor.
- 8.2 The common areas of the building interior shall be connected to one zone and the exterior page speakers on the covered walkways and Exterior page horns shall be connected to another zone. The analog paging speakers and horns shall be installed as a (2) Two zone system from the Control Software provided by the 27 20 00 Contractor.
- 8.3 The 27 20 00 Contractor shall coordinate all paging system zoning, paging system input levels to the amplifiers from the interface devices and paging system pre-recorded messages with the District. The paging requirements within the actual classroom shall be provided by the Classroom AV System speakers.
- 8.4 The 27 10 00 Contractor shall be responsible for testing all paging speakers and horns and ensuring the proper volume levels are set from the amplifiers. Provide (8) man hours for re-adjustment of the paging speakers and horns volume per the District's requirements 4 weeks after the school has been occupied by the students. Check with School Administrative Staff for areas that are either too loud or too soft. The final adjustments to the individual speakers, horns and amplifiers shall be documented and furnished as part of the As-Built documents for the project.
- 8.5 The 27 10 00 Contractor shall furnish and install all cabling for the analog speakers and horns, Analog Paging Speakers, Paging Horns and Amplifiers associated with the IP-Based Paging System. Analog paging speakers and horns shall be as manufactured by Atlas Sound. These speakers must be procured from Atlas Sound Authorized distributors. Contact Atlas/IED for a list of authorized distributors.

- 8.6 The 27 10 00 Contractor shall be responsible for providing enclosures for all analog speakers and horns. Contractor shall provide vandal resistant screws with all enclosures for attachment of the speaker/horn grilles and baffles. Exterior locations shall be provided with stainless-steel enclosures and stainless-steel vandal resistant screws.
- 8.7 All surface mounted enclosures shall be furnished and installed by the 27 10 00 Contractor in all areas shown in the floor plans including exterior surface mounted enclosures.
- 8.8 Recessed flush mount enclosures shall be furnished by the 27 10 00 Contractor and installed by the Division 26 Contractor, unless otherwise noted on the Legend or Floor Plans. Recessed enclosures shall be furnished with manufacturer provided “wing” bracket panels that attach to the side of the enclosure and shall be used for attachment to the structural members.
- 8.9 Provide amplifiers for the analog paging speakers and horns connected to the IP-Based Paging System Interface devices in the IDF Room. Amplifiers shall be rack mounted in the IDF equipment rack. Provide rack mount adapter bracket as required to mount one or two amplifiers on the rack side-by-side. Provide size of amplifiers to service the quantity of horns and speakers as shown on the drawings. A separate amplifier must be provided for each Paging Zone. Size of amplifier shall be determined by the load, plus 25% expansion capacity. Larger amplifier may be required for a single zone depending on quantity of horns and speakers requiring amplification. Contractor is responsible for providing sufficient power amplification to service all speakers and horns. Contractor is responsible for connecting the amplifiers to the IP-Based paging interface devices and insuring proper operation between the interface devices and amplifiers. All speakers/horns shall be connected to the amplifiers at 70 volts.
- 8.9.1 Provide amplifier choice based on load; Approved Model; Atlas/IED Model #PA601 (or approved equals). Connect the “line out” terminal on the IP-Based paging interface devices provided by the 27 20 00 Contractor to the amplifier input terminals. Confirm with 27 20 00 Contractor whether a balanced or unbalanced line level audio signal will be provided.
- 8.9.2 Route the output from the amplifiers to the terminal strips on the Communications backboard for connection to the cabling terminal strips for the speakers and horns.
- 8.9.3 Provide rack mount adapter bracket Model #AARMK2-5, one bracket for each pair of amplifiers provided. If there is a single amplifier to be installed at the rack, the amplifier would still require the rack mount bracket. Provide optional Level Control Security Covers for all models.
- 8.9.4 Multi-zone amplifier Approved Models: Atlas/IED #CP400 (2-zone), QSC #CX108V (8 zone). Amplifiers rated at 100 watts/channel or 70 volts.
- 8.10 Analog Paging Speakers and Horns

- 8.10.1 Recessed accessible ceiling mounted speaker – Atlas/IED Part #DT12 1’x2’ drop in type speaker with external tap selector, recessed ceiling enclosure and tile bridge. Speaker baffle shall be white power coat epoxy finish. Speaker shall be tapped at a minimum of 2 watts. Louder areas (such as common hallways) shall be tapped at 5 watts.
- 8.10.2 Recessed non-accessible ceiling mounted speaker – Atlas/IED Part #SD72WV speaker with volume control, with recessed round ceiling enclosure Part #95-8 mounted in the hard lid ceiling. Speaker baffle shall be white powder coat epoxy finish. Speaker shall be tapped at a minimum of 2 watts. Louder areas (such as common hallways or exterior covered walkways) shall be tapped at 5 watts.
- 8.10.3 All ceiling mounted speakers shall be provided with a minimum of (1) 12-AWG ceiling support wire securely attached to the structure above with either a power actuated nail into the concrete deck above or with a screw type hanger into the wood structural members. The speaker shall not depend on the ceiling tile grid for support.
- 8.10.4 Surface mounted speaker – Atlas/IED Part #VP14ENC with square surface mount slanted enclosure. Provide 8” speaker plus baffle – Atlas/IED Part #VP14MB with white power coat epoxy finish and shall be attached to the enclosure with vandal-resistant screws. Speaker shall be tapped at a minimum of 2 watts. The speaker shall be surface mounted on the wall, over J-Box furnished by the Division 26 Contractor. Louder areas (such as common hallways or exterior covered walkways) shall be tapped at 5 watts.
- 8.10.5 Recessed Exterior Paging Horn – Provide Atlas/IED Part #VP161-APF Vandal Proof Baffle, #APF-15T series Horn/Loudspeaker, and #161RES stainless steel series enclosure. Unit must be weather and vandal resistant. All horns shall be tapped at 15 watts.
- 8.10.6 Surface Mounted Exterior Paging Horn – Provide Atlas/IED Part #VP161-APF Vandal Proof Baffle, #APF-15T series Horn/Loudspeaker, and #161SES stainless steel series enclosure. Unit must be vandal and weather resistant. All horns shall be tapped at 15 watts.
- 8.10.7 All analog speakers and horn grilles and baffles must be provided with vandal resistant screws. Contractor shall furnish (2) tools for removal of the screws to the District IT department.
- 8.10.8 Contractor is responsible for proper paging coverage and tap settings of the speakers and horns. Contractor shall confirm tap settings are adequate after the school has been occupied, testing the paging after the students have occupied the campus to properly judge the ambient noise levels and make adjustments before the project completion.

8.11 All wiring shall test free of grounds and shorts.

- 8.12 Each speaker location cable shall be home run to the IDF Room Communications backboard. Provide 1-pair, 18-AWG unshielded CMR rated speaker cable by West Penn #224 (or approved equal) to each speaker location. Terminate speaker cable on terminal strips at the backboard. All speakers shall be home run to the IDF location. Speakers/Horns may not be run in a series, unless otherwise shown on the drawings. All speaker runs shall be numbered and labeled.
- 8.13 Cross connect the speaker or horn wiring from the amplifiers output on the terminal strips. All connections shall be labeled at the terminal strip with the Zone and Building Name or Number.
- 8.14 All paging speaker cables installed shall contain all necessary conductors and/or cables to all devices shown on the Drawings and the Contractor shall make all necessary conductor terminations to all devices for a complete system.
- 8.15 All cables routed underground shall be suitable for wet location provided with UL listed wet location insulation or flooded type cable construction as manufactured by West Penn Aquaseal #AQ224 (or approved equal).
- 8.16 Wrap around labels are required on all cable connections at the rear of the amplifier, at the zone controller and at the terminal strip for all cabling to the speakers or connections between equipment. Label shall clearly define paging zones, room numbers or type of port. Label shall be Brady self-Laminating 1.2" x 1/5" wrap around type #29689 – (No approved equal).

PART 9 - EMERGENCY CALL STATION AT 2ND FLOOR ELEVATOR LANDING

- 9.1 The Contractor shall furnish and install the Emergency Call Station at the 2nd Floor Elevator Landing where shown on the project drawings. The Emergency Call Station is an analog telephone device with automatic dialing capabilities. It shall not contain either a handset or dialpad and shall be activated with the provided Push Button. The Emergency Call Station shall be provided with a clear heavy-duty Plastic or Plexiglas cover to prevent unintended activation. The Emergency Call Station is intended for the use of handicapped persons stranded on the 2nd Floor in the event of an Elevator failure or power outage.
- 9.2 The Emergency Call Station shall be tied into the Elevator Equipment and shall use the same analog trunk that is provided for the Emergency Phone within the Elevator Cab.
- 9.3 Coordinate "Workstation Outlets" Paragraph below with other items specified to be mounted in workstation faceplates. Revise paragraph if faceplate elevations are on Drawings.
- 9.4 All final connections to the Elevator Equipment shall be performed by the Elevator Contractor. Coordinate with the Construction Manager and the Elevator Contractor for the procedures required to provide the Elevator Contractor with the analog telephone line from the MPOE location and the cable connection to the Emergency Call Station. The Contractor shall provide 25-feet of slack on the Category-6 UTP cables to the Elevator Equipment location designated by the Elevator Contractor.

- 9.5 Final connections to the analog telephone lines from the MPOE for each Elevator shall be provided by the Contractor. Coordinate with the District Facilities and IT Departments for a list of analog trunks ordered by the District for the Elevator phone connections. The analog lines shall be routed from the MPOE location to the MDF Room and IDF Rooms or Cabinets via the Voice Feed Trunks provided by the 27 10 00 Contractor. Refer to the Electrical detail drawings for connectivity requirements.
- 9.6 The Emergency Call Station shall be provided with a recessed backcan for mounting of the Call Station Panel to the wall. The backcan shall be furnished by the 27 10 00 Contractor and installed by the Division 26 Contractor during the electrical rough-in phase of the project. The 27 10 00 Contractor shall coordinate with the Division 26 Contractor for timing and delivery of the backcans so as to not cause any delay to the project timeline. The 27 10 00 Contractor shall be responsible for delivering the backcans to the project site in a timely fashion and handing off the backcans to the Division 26 Contractor for installation. A 1" conduit shall be provided from the Emergency Call Station to the Elevator equipment by the Division 26 Contractor for the analog telephone line connection.
- 9.7 Power for the Emergency Call Station shall be provided by the manufacturer supplied 24VDC power supply. The power supply shall be plugged into a 15A, 120V duplex outlet located in the nearest accessible ceiling space where shown on the Electrical Floor Plans. Provide a shielded 3-conductor, 18AWG low voltage power cable from the power supply to the Emergency Call Station. Terminate cable on the connector on the rear of the main panel. A 3/4" conduit shall be provided from the Emergency Call Station to the power supply outlet location by the Division 26 Contractor for the low voltage power cable connection.
- 9.8 Refer to the Electrical detail drawings and project floor plans for additional requirements. The Emergency Call Station shall be installed so that the Push Button is at 48" A.F.F, as shown in the detail drawings.
- 9.9 Emergency Call Station Specifications
- 9.9.1 The Emergency Call Station must be in full compliance with ADA requirements. Emergency Call Station requires a hands-free speakerphone with an LED to indicate status of call.
- 9.9.2 The Emergency Call Station must allow programming of a specific location message indicating the location of the Emergency Call Station. This allows rescue personnel to know the location of the activated Emergency Call Station.
- 9.9.3 Recessed mounting backcan for flush wall mounting
- 9.9.4 Stainless Steel Panel with the word "Emergency", Symbol of the telephone handset, Push Button for device activation and speaker with two-way communications capability.
- 9.9.5 Emergency Call Station wording must include "Emergency Phone", International Phone Symbol and raised Braille lettering

- 9.9.6 The Emergency Call Station shall have an ADA compliant and vandal resistant speakerphone.
- 9.9.7 Call Box must have an LED that will light up upon push of the button. The LED shall be a solid color when the Call Box is activated and will flash when call has been answered.
- 9.9.8 The Emergency Call Station shall be hands-free and be a push-button-once to talk system. Once the button has been pushed, the Emergency Call Station will call the location Pre-designated by the District. If no answer at the Pre-designated number, it will automatically call pre-programmed emergency numbers. The Emergency Call Station must be capable of being programmed with up to 5 emergency numbers.
- 9.9.9 Call Box shall have location message capability. Call Box must have a minimum 18-second recordable message capability, programmable to play 1 or 2 times. Call Box shall notify called party of the location of the call upon being received at the emergency dispatch number provided by the District.
- 9.9.10 Call Box shall be capable of allowing the called party to replay the location message if necessary to ensure an understanding of the caller location.
- 9.9.11 If number provided by the District is within the building or local campus, and is not attended 24 hours a day, the Call Box must dial a secondary location outside the building to activate two-way off-site person to person voice communications.
- 9.9.12 Once call has been made (button pushed), the call can only be terminated by the called party.
- 9.9.13 Protective plastic or Plexiglas protective cover to prevent false call initiation
- 9.9.14 Built-in 7.2V 300mAH Back-up Battery included with Call Station to maintain backup power for a minimum of 4 hours of talk time.
- 9.9.15 Provide programming of the Emergency Call Station auto-dialer system and recorded message playback upon activation. Contractor shall program a minimum of (3) alternate telephone numbers, in addition to the main pre-designated number, to insure the call will be answered. Provide recording of the message. Emergency Call Station shall have on-board EEPROM memory to protect programming.
- 9.9.16 Call Station powered by RATH® 24vdc Power Supply Part # 2500-PWR24 (Or Approved Equal). Refer to the Electrical Power Drawings for the location of the outlet for the Elevator Emergency Call Station Power Supply. Extend power as required to the Call Station from the electrical outlet.
- 9.9.17 Emergency Call Station shall be as manufactured by RATH® Communications Model #2100-958SSRC2 (Or Approved Equal).

- 9.9.18 Provide Cat-6 UTP cable from the Emergency Call Station to the Elevator Equipment as shown in the Electrical Details. Terminate on manufacturer furnished terminal on back of panel.

PART 10 - INSTALLATION

- 10.1 Upon completion of 10% of the cabling installation, the Contractor shall notify the Project Engineer for an inspection of the methods and types of materials used on the project. The Contractor shall give a minimum of 72 hours notification to the Project Engineer for the scheduling of the inspection. The Contractor will be given a written review of the findings, so if adjustments are required, they can be done before the project proceeds. The Contractor shall be responsible for adhering to the findings and a follow-up inspection will not be provided.
- 10.2 Pull strings shall be provided with all cable runs including but not limited to; conduit stub ups, conduit sleeves, cable trays, open wiring routes, innerduct, and point-to-point conduits. Pull strings shall be free from cable bundles in open wiring routes. Pull strings shall not be substituted for pull ropes for the exterior site conduits.
- 10.3 Velcro cable management straps are required on all Category-6 cable bundles, the last 20 feet or upon entry into equipment closet, a maximum of 12" apart. Cable bundles shall also be routed through cable management or "D" rings in the equipment closet.
- 10.4 Data Contractor shall supply protective bushings or slide on rings 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. Contractor shall submit planned protection bushings prior to installation of cabling for approval.
- 10.5 Velcro cable management straps are required on the cabling in the rear section of the vertical managers on the equipment racks. Straps shall be a maximum of 12" apart. At a minimum, Velcro straps shall be provided at each point the cables are routed to the patch panels from the main bundle.
- 10.6 Every fiber in every fiber optic cable must be terminated at both ends on a fiber patch panel in the MDF/IDF closet or cabinet location. Termination shall be accomplished using the correct style of connectors as directed by the District with a strain relief boot. All connectors shall be of the same manufacture to ensure compatibility. Polarity of fiber strands must be observed at all times.
- 10.7 Labeling
- 10.7.1 Each cable run shall be permanently labeled at each end with a unique sequential number which corresponds to a similar number provided for each data outlet and patch panel point. A printed label shall be placed at each of the following locations;
- 10.7.1.1 On the cable at the rear of the patch panel or termination block. Requires the use of a self-laminating wrap around label. Brady Label

self-laminating 1.2" by 1.5" wrap around label Part #29689 (NO ACCEPTABLE EQUAL).

- 10.7.1.2 On each cable in the j-box behind the faceplate location. Requires the use of a self-laminating wrap around label. Brady Label self-laminating 1.2" by 1.5" wrap around label Part #29689 (NO ACCEPTABLE EQUAL).
 - 10.7.1.3 On the cable at the terminal strip prior to termination point. Requires the use of a self-laminating wrap around label. Brady Label self-laminating 1.2" by 1.5" wrap around label Part #29689 (NO ACCEPTABLE EQUAL).
 - 10.7.1.4 On the face of the patch panel, provide a 3/4" by 3/4" label with a letter or number identifying the patch panel designation. For special purpose data connections such as WAP, Audio-Visual, IP Page and IP Camera ports, the label shall be designated with colored label icon or marker.
 - 10.7.1.5 On the face of the faceplate in the label holder window. The label shall be clearly defined with a minimum #10 font size.
- 10.7.2 Hand written labels are not permitted. Where cable ID includes room number identification, the Contractor shall obtain written verification of final room numbers prior to beginning labeling (numbers on plans do not always match final room numbers). Cable pulling cross reference lists will not be accepted with final documentation.
- 10.7.3 Each patch panel port shall be identified with a unique sequential labeling scheme. Port identification labeling pattern shall be consistent throughout the project.
- 10.7.4 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.
- 10.7.5 All fiber optic and UTP feed cables shall be identified with a permanent, water resistant, printed labels. Labeling information shall include closet identifications, quantity of conductors (UTP) or strands (fiber) and house pair designations (UTP). Cables shall be labeled in the IDF/MDF closets at the site conduit entrance point, Riser conduit entrance point and prior to entering either punch blocks or patch panels. Labels for fiber and copper feeds shall include both the name of the origination point and the destination point, house pair or house fiber strand count, cable composition (ie:12-Strand MM 50/125 LO; 6-Strand SM). See details for additional requirements.
- 10.7.6 Labeling will follow recommended EIA/TIA standards or as requested by the customer. Contractor will confirm labeling pattern prior to final identification or

testing. All test results will be identified by the final labeling scheme. Contractor shall be required to have the labeling scheme approved in writing by the District IT Director prior to manufacture or installation of the labeling.

- 10.7.7 All fiber optic cables and/or innerduct shall be tagged with fiber optic warning tags in every manhole or pullbox. Fiber warning tags shall also be placed at each end of the cable in the termination closets in clear view. A minimum of (3) tags are required at each end, with a label tag on each cable in the service loop. Fiber warning tags shall be placed on fiber optic cable and/or innerduct routed through open ceiling environments at increments no less than 15 feet apart.
- 10.7.8 Refer to detail drawings for additional labeling requirements.
- 10.8 Where open wiring cables are run through the ceiling space (only permitted where specifically noted on the drawings), the wire shall be bundled together and supported above the ceiling.
- 10.9 All cables must be fastened to the building structure via “j-hooks” or an approved Category 6 suspension system, and not directly in contact with ceiling system. For “j-hooks” maximum fill capacity is as follows: 1-5/16" hooks – 35 cables; 2" hooks - 60 cables; 4" hooks - 120 cables. For quantities beyond 120 cables use a sling support system such as “Erico Cable Cat” or equal. Maximum fill capacity 200 cables. D-rings, “Caddy #WMX cable hangar”, “Caddy Bridle Rings”, drive rings or any other type of wire ring support is not allowed.
- 10.10 All new cabling shall include the support systems (J-hooks, saddles, Velcro ties, etc.) regardless if the outlets are shown as new locations or existing locations where the cables are to be replaced.
- 10.11 Where cables pass through a fire-resistant portion of the structure, conduit sleeves shall be provided to maintain the rating of the wall penetrated. Sealing of all penetrations with an approved fire barrier is required. Conduits and sleeves must remain accessible for future use. Permanent sealants may not be used to seal sleeves and conduits.
 - 10.11.1 The 27 10 00 Contractor shall be responsible for fire-stopping all unused conduit sleeves in the ceiling or through rated walls. The Electrical Contractor shall be responsible for fire-stopping around the conduit or sleeve, unless the sleeve is installed by the 27 10 00 Contractor, in which case, the 27 10 00 Contractor shall be responsible for all fire-stopping requirements.
 - 10.11.2 Expanding foam is not an acceptable sealant for any conduit opening. Contractor shall be responsible for complete replacement of the conduit and cabling in any conduit filled with expanding foam used as a sealant.
- 10.12 Fiber optic feed cables connecting to equipment racks from the MDF Room or from an adjacent IDF location, shall be installed with not less than a 20-foot service loop between the rack and mounted on the backboard. See drawings for fiber optic service loop requirements.

- 10.13 Provide 6 inches of cable slack at computer data system outlets inside conduit box.
- 10.14 In an accessible ceiling area, provide a 10-foot (stored in a Figure-8 configuration) service loop above the all data/voice outlet locations. Service loop must be securely tied up off of ceiling tiles or ceiling surface and supported at two opposite points. Neatly coil cable without exceeding minimum bend radius limitations. Do not provide length in excess of 15 feet, as it may cause improper test results and errors.
- 10.15 Do not provide a service loop in the MDF/IDF Room on the UTP cables, unless otherwise noted. Cables shall be neatly routed around the perimeter of the room to the cable runway from the point of entrance into the room.
- 10.16 The minimum bending radius for all cables and the maximum pulling tension shall not exceed manufacturer's recommendations.
- 10.17 Cables installed in manholes and pullboxes shall be supported with Velcro ties or loosely fitted UV rated tie wraps, on wall mounted cable support racks. The cables shall be clearly labeled in the manhole or pullbox.
- 10.18 Provide a full 360-degree loop of slack cable around manhole and pullbox interiors. Cables entering handholes from the bottom, shall not be allowed to touch the bottom of the cover when closed and shall not be pinched or crushed in any way.
- 10.19 Cable pulling shall use a split mesh grip over the cable jacket. Connection directly to optical fibers and copper wire conductors shall not occur.
- 10.20 When pulled through conduits, cable pulling lubricants shall be continuously applied to all cables and be specifically approved by the manufacturer.
- 10.21 Where cables are pulled through or pulled from a center of run, pull without splices or terminations, lead out the cables at all manholes, pullboxes, and conduits, taking care to feed them in again by hand for the next run.
- 10.22 For each cable pull where a cable direction change is required, flexible feed-in tubes, pullout devices, multi-segmented sheaves, etc., shall be used to ensure proper cable pulling tensions and side wall pressures. Cables shall not be pulled directly around a short right-angle bend. Any device or surface the cable comes in contact with when under pull-in tension shall have a minimum radius 50% greater than the final specified minimum installed cable bending radius. The maximum possible size radius sheaves and feed-in tubes, usable in the available working space, shall be provided in all situations, to ensure the minimum possible cable sidewall pulling pressure. Do not use devices with multi-segment "roller" type sheaves.
- 10.23 Cable lengths over 250 feet shall be machine pulled, not hand pulled. Cables shall be pulled in a continuous, smooth operation without jerking or stop-start motion after initiation of pull. Maximum cable pulling speed shall be less than 50 feet per minute. Minimum pulling speed shall be greater than 15 feet per minute.

- 10.24 A pull string shall be placed with all UTP and paging station cables at the time of installation. Conduit runs and surface raceway for station cabling shall be furnished with a minimum 2-Ply spiral wrap style, pull string rated for 240 ft/lbs. pulling strength, such as manufactured by Greenlee #431 or approved equal. Includes all conduit stubs and cables routed through open ceilings and cable trays. Pull strings shall be tied off in the junction box and in the ceiling. Provision for the installation of the pull string shall apply to all empty and spare conduits as well. Single ply type pull string will not be accepted as a substitute for the 2-ply pull string.
- 10.25 A measuring pull tape shall be placed with all feed cables at the time of installation. Indoor riser and Outdoor conduit runs between buildings designated for feed cabling, in excess of 150 feet shall be provided with a minimum ½" polyaramid style, measuring true tape pull string annotated with footage increments rated for 2500 ft/lbs. pulling strength, such as manufactured by Greenlee #39245 or approved equal. Conduit runs less than 150 feet shall be furnished with a ¼" polyaramid style, measuring true tape pull string annotated with footage increments rated for 1250 ft/lbs. pulling strength, such as manufactured by Greenlee #39243 or approved equal. Provision for the installation of the measuring pull tape shall apply to all empty and spare conduits as well. Standard twine style pull strings and standard nylon or polypropylene style pull ropes will not be accepted as a substitute for the polyaramid measuring tape type pull string.
- 10.26 When pulling cable through conduit, cables shall be pulled straight into or out of the raceway without bends at the raceway entrance or exit. Pull in cable from the end having the sharpest bend (i.e., bend shall be closest to the reel.) Keep pulling tension to minimum by liberal use of lubricant, hand turning of reel, and slack feeding of cable into duct entrance. Employ not less than one man at reel and one at manhole or pullbox during this operation. Cables shall be pulled directly from cable reels.
- 10.27 All cables shall be new and extend continuous from each MDF or IDF backboard or rack to all outlet locations.
- 10.28 Where cables are not installed in a conduit or other raceway system, they shall not be routed parallel with other line voltage equipment or wiring (120 volt and above) within 36" or within 12" of line voltage equipment or wiring where crossing.
- 10.29 Where OSP-Rated UTP cables or OSP-Rated fiber optic cables are routed exposed through ceilings for more than 50'-0", Contractor shall install the cable in innerduct or EMT conduit in the ceiling. Innerduct installed in the accessible ceiling space shall be a minimum of riser rated and a minimum of 1" in diameter. Innerduct shall be supported a minimum of every 3-feet to the structural members.

PART 11 - TESTING

- 11.1 All Category-6 cables shall be point to point (link) tested after installation/termination, and verified to operate at minimum 1000Mbps. Performance of installed cables shall satisfy all current addendums to the EIA/TIA 568A standard for Category-6 wiring. In addition, testing shall satisfy all proposed amendments to the existing ISO/IEC requirements. The wiring shall support all specified communication protocols. Testing shall support the Category-6 requirements by the EIA/TIA.

- 11.2 All Augmented Category-6 cables shall be point to point (link) tested after installation/termination and verified to operate at minimum 10000Mbps. Performance of installed cables shall satisfy all current addendums to the EIA/TIA 568A standard for Augmented Category-6 wiring. In addition, testing shall satisfy all proposed amendments to the existing ISO/IEC requirements. The wiring shall support all specified communication protocols. Testing shall support the Augmented Category-6 requirements by the EIA/TIA.
- 11.3 Upon completion of testing cable links for both copper and fiber optic cabling, the Contractor shall supply a copy of the original database files downloaded from the tester in original format on a USB Flash Drive. Contractor shall provide with the testing database files, an original copy of the tester's manufacturer software program (included in original cost) for record management and archiving, in a Windows format (i.e.; Fluke Linkware software program)
- 11.3.1 The manufacturer's software program will be used by the Project Engineer to review all test results, and then turned over to the District to keep as their record copy with the final approved test results. Provide (3) copies of tests on USB Flash drive. Do not submit test results for review in Excel or PDF file formats, as the submittal will be rejected and not reviewed.
- 11.4 Contractor will repair or replace cable runs or connecting hardware that do not meet specified criteria.
- 11.5 Multimode fiber optic cables shall be tested bi-directionally at 850nm and 1300nm. Single mode fiber optic cable shall be tested bi-directionally at 1310nm and 1550nm. All fiber strands shall be tested with an OTDR (Optical Time Domain Reflectometer). All fiber test results shall contain final source and destination information that matches IDF or MDF labeling shown on the fiber optic patch panels and final documentation. OTDR test results shall be included with the copper test results and submitted with the tester's software for review. Do not submit test results for review in Excel or PDF file formats, as the submittal will be rejected and not reviewed.
- 11.6 Test procedures shall comply with EIA/TIA 526-14 Method B. Test results shall meet the minimum following criteria:
- 11.6.1 Fiber optic test results shall not exceed 2db total attenuation loss in addition to inherent loss published by manufacturer tested at minimum 2000 Mhz for 850nm and 500 Mhz for 1300nm for the fiber optic cable.
- 11.6.2 Test all data cables minimum Category-6 UTP cable to test results for "Channel Testing" requirements @ 250 Mhz per current EIA/TIA requirements. Any cables which do not meet these minimum requirements shall be replaced or repaired at no cost to the District.
- 11.6.3 Test all data cables minimum Augmented Category-6 UTP cable to test results for "Channel Testing" requirements @ 500 Mhz per current EIA/TIA draft requirements. Any cables which do not meet these minimum requirements shall be replaced or repaired at no cost to the District.

- 11.7 End to end attenuation testing shall be performed with a temporary test jumper cable at each end of the installed fiber cable. The test jumper utilized shall be the same fiber core size and grade of glass as the installed cable. The measured attenuation of the test jumpers, test connectors, and test interconnection sleeve between the two test jumpers shall be less than 1dB as calibrated at the time of the test at indicated wave lengths and frequencies. Test jumpers shall be “zeroed out” before testing of fiber strands begins.

PART 12 – CLOSE-OUT DOCUMENTATION

- 12.1 Final As-Built Drawing Submittals - Provide (1) hard bound copy of “E-size” As-Built drawings and (3) copies on USB Flash Drive in AutoCAD (2014 or newer version) format. A Hand marked-up copy of the original construction drawings will not be accepted as the final As-Built drawing submittal. Final As-Built drawings shall include copies of the floor plan drawings of each building, detailed elevations of each MDF or IDF locating all equipment, quantities outlets and speaker locations, locations of all sleeves and identification of all final cable routes. In addition, the drawings shall include all outlet locations with cable identification numbers.

END OF SECTION 272000

SECTION 272000 - INTEGRATED AUDIO/VISUAL SYSTEM**PART 1 – GENERAL****SUMMARY**

- 1.1 The Contractor shall furnish all labor, project management, materials, tools, equipment, and resources necessary for the installation, startup, and testing of the system shown on the plans and described in the specifications.
- 1.2 Related Specification Sections:
 - 1.2.1 Section 26 01 00 -General Provisions
 - 1.2.2 Section 26 05 33 -Conduit and Fitting
 - 1.2.3 Section 26 05 19 -Conductors
 - 1.2.4 Section 26 05 34 -Outlet and Junction Boxes
- 1.3 The Contractor shall furnish and install the system as defined by the plans and specifications. The Contractor must demonstrate to the Owner that the system is complete and complies with all operational requirements set forth in the plans and specifications.
- 1.4 The work covered under this section of the specifications consists of furnishing all labor, equipment, supplies and materials, and in performing all operations necessary for the turnkey and fully completed installation of an audio/ video system in accordance with the specifications and accompanying drawings, except as specifically noted otherwise.
- 1.5 Cables for the system shall be pulled through the conduit systems furnished by the building Contractor. The 27 20 00 Contractor shall be responsible for providing all cables required and for coordinating and supervising the cable installation. The 27 20 00 Contractor shall be responsible for ensuring the integrity of the cables before and after installation.
- 1.6 Work Excluded:
 - 1.6.1 Excluded from this work shall be any and all general construction services regarding masonry and general carpentry services. Those services are to be provided and installed by the general Contractor.
 - 1.6.2 Conduit/raceways, sleeves, cable trays, electrical boxes, hand holes, pullboxes, etc. required for the system shall be furnished and installed by the Electrical Contractor. The conduit/raceways and electrical boxes furnished and installed under Electrical Contractor shall conform with the requirements of the drawings and specifications for the system.
- 1.7 In order to ensure project cohesion a single point of contact is required to provide a "TURNKEY" solution. The work covered under this section of the specification consists of furnishing all labor; cabling; equipment; software; supplies; materials and training. The Contractor will perform all operations necessary for the "TURNKEY" and fully completed

installation in accordance with the specifications herein. As such, the successful Contractor must be factory trained on all aspects of system hardware. The successful Contractor shall be a California licensed C7 or 10 premise wiring Contractor as defined in this specification. SubContractors may not be utilized in the implementation of the plant wiring installation.

- 1.8 Approval to bid shall not release the Contractor from full specification compliance requirements. Final system acceptance testing shall govern final system acceptance and compliance with the specifications.
- 1.9 Failure to provide a functional equivalent shall result in the removal of the alternate system at the Contractor's expense.
- 1.10 These specifications contain statements which may be more definitive or more restrictive than those contained in the General Conditions. Where these statements occur, they shall take precedence over the General Conditions.
- 1.11 Where the words 'provide' or 'provision' is used, it shall be definitely interpreted as 'furnishing and installing complete in operating condition'. Where the words 'as indicated' or 'as shown' are used, it shall mean as shown on contract drawings.
- 1.12 Where items are specified in the singular, this division shall provide the quantity as shown on drawings plus any spares or extras mentioned on drawings or specifications. All specified and supplied equipment shall be new.

DEFINITIONS

- 1.13 Concealed: Hidden from sight, as in trenches, chases, hollow construction, or above furred spaces, hung ceilings - acoustical or plastic type, or exposed to view only in tunnels, attics, shafts, crawl spaces, unfinished spaces, or other areas solely for maintenance and repair.
- 1.14 Exposed, Non-Concealed, Unfinished Space: A room or space that is ordinarily accessible only to building maintenance personnel, a room noted on the 'finish schedule' with exposed and unpainted construction for walls, floors, or ceilings or specifically mentioned as 'unfinished'.
- 1.15 Finish Space: Any space ordinarily visible, including exterior areas.

Contractor Qualifications

- 1.16 The successful bidder shall be a California licensed C7 or C10 premise wiring Contractor as defined in this specification. Subcontractors may not be utilized in the implementation of the installation or programming.
- 1.17 The successful bidder shall have design staff with a minimum of the following certifications and shall include all certifications with their bid.
 - 1.17.1 (1) BICSI certified (RCDD) Registered Communications Distribution Designer.

- 1.17.2 CTS Certification
- 1.17.3 Extron XTP Systems Engineer
- 1.17.4 Extron TLP programming certifications
- 1.17.5 Extron Global Configuration Certification
- 1.18 The successful bidder shall have installation staff with a minimum of the following and shall include all certifications with their bid.
 - 1.18.1 CTS-I certification
 - 1.18.2 Extron Advanced A/V Certifications.
 - 1.18.3 Contractor must have a minimum of (8) full time certified installation technicians with Extron Certifications (include certifications with submittals)
- 1.19 All bidders must provide a listing of two similar size projects having the same scope of work using the proposed information delivery equipment. This listing shall be complete with facility names, completion dates, names of contacts, and their telephone numbers. Referenced projects must have been completed in the past 18 months.
- 1.20 The bidder shall have a factory trained service department. The service department shall be on call 24 hours a day, 365 days a year, to arrive and initiate onsite service the specified equipment upon (24) hours notice.
- 1.21 The Contractor shall employ factory-trained technical/service personnel for service and maintenance of the system. Their résumés will be required. The factory-trained technical/service personnel shall have a minimum of two years experience installing the proposed system. The Bidder shall submit the names and copies of the certificates issued by the factory. The bidder shall instruct the Owner's technical personnel in the operation, care, and maintenance of the system.

CODE COMPLIANCE

- 1.22 All material and equipment shall be clearly listed, labeled, or certified by Underwriters Laboratories, Inc. All power supplies and computers shall be clearly UL Listed. Any system which is not UL Listed at time of bid will be rejected.
- 1.23 All acceptable systems shall be approved under Part 15, Subpart B, Section 15.107b of the FCC Rules and Regulations. Bidders must provide the FCC Registration Number of the proposed system. Systems that are not in compliance with the FCC will not be considered. Any system that is not FCC compliant at time of bid will be rejected. All equipment must be clearly labeled with FCC compliance stickers.
- 1.24 The system shall be installed in accordance with local and national electrical codes.

- 1.25 The manufacturer and Contractor shall provide the Owner with a release for use of all copyright materials, corporate logos, and corporate trademarks at time of bid.

SUBMITTALS

1.26 General Submittal Requirements

- 1.26.1 Phase I Submittal shall be made in electronic format within (20) working days after the award of the contract by the District. This submittal shall include the following:
- 1.26.2 Complete Bill of Materials in Excel Spreadsheet format with bills of quantities, including all materials, components, devices, and equipment required for the work. The bills of quantities shall be tabulated respective of each and every system as specified, and shall contain the following information for each Section listed:
- 1.26.3 Description and quantity of each product.
- 1.26.4 Manufacturer's Name and Model Number.
- 1.26.5 Manufacturer's Specification Sheet or Cut Sheet. Material Cut Sheets shall provide detailed product information and shall be original manufacturer product bulletins. **Copies of material information from vendor websites shall not be considered equal and will not be excepted.**
- 1.26.6 Material Cut Sheet part number provided shall be highlighted or provided with an arrow directed at the corresponding part number.
- 1.26.7 Specification Item Number referenced for each required product or if not shown in the specifications, Drawing Detail Number being referenced. (ie; Spec. 271000 Item 2.1 or DWG E4.15/#1)
- 1.26.8 Include with submittals all warranty information and a description of support and maintenance services to be provided. Also include all licenses and maintenance agreements required for continued operation of the equipment.
- 1.27 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 in a CAD Software. Submission shall include electronic print copies to match the contract drawings, and Phase II submittals drawings shall include the following.
- 1.27.1 MDF and IDF equipment rack or cabinet elevations will be required to be provided including cable routing, grounding, support, UPS, network electronics, etc. and position of all components in the rack or cabinet.
- 1.27.2 Provide labeling plan which identifies the proposed scheme for identifying all components including Racks, patch panels (fiber and copper), site distribution

feed cables, horizontal station cables and site conduit systems (handholes, pullboxes, etc.).

1.28 Common submittal mistakes which will result in submittals being rejected:

- 1.28.1 Not including the qualifications of the installing Contractor Company and Contractor's Staff.
- 1.28.2 Not including all items listed in the above itemized description.
- 1.28.3 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed (provided for the project) or crossing out the items which are not applicable.
- 1.28.4 Not including actual manufacturer's cut sheets or catalog information of proposed products.
- 1.28.5 Do not provide website sales pages instead of Material Cut Sheets. Printing the entire web page with advertising and non-applicable items or information will not be acceptable.
- 1.28.6 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" or "to be determined later" statements. The products being submitted must be the products installed.

1.29 Component Samples and Mock-ups

- 1.29.1 Provide one full size installation sample mock-up of a normal wall faceplate for approval. All samples are to be fully labeled per these specifications. Samples are to be delivered to the Construction Manager's office on site prior to installation.
- 1.29.2 All sample mock-ups are intended to represent the components that are to be installed as part of this project. They are to be provided with all associated components and labeling necessary to make up a complete mock-up. Installation shall not proceed until the Owner's Representative has approved the samples. Once samples and other documents have been submitted and inspected by the Owners Representative approved, they shall be retained. Any installation that does not meet this standard shall be replaced or re-worked as approved by the Owners' Representative at no cost to the project.

1.30 The Contractor shall make a written request directly to Johnson Consulting Engineers for electronic drawing files (CAD). As a part of the written request, please include the following information:

- 1.30.1 Clearly indicate Project Name and Client, Johnson Consulting Job Number (located in bottom left corner of JCE Engineering Stamp) and each drawing Sheet Number required (i.e., E1.1, E2.1, E4.1 etc.).

- 1.30.2 Identify the name, Company, Title, phone number, mailing address and e-mail address of the person to receive the files.
- 1.30.3 Detail or Riser diagram sheets, System Schematic drawings or any other drawings other than floor plans or site plans, will not be made available to the Contractor.
- 1.30.4 Files will only be provided in the AutoCAD format in which they were created (i.e., version 2015 or version 2016). Files will not be made available in REVIT format.
- 1.31 Requests for files will be processed as soon as possible; a minimum of (7) working days should be the normal processing time. The Contractor shall be completely responsible for requesting the files in time for their use and delays in requesting files will not alleviate the Contractor from submitting required documents within the required timeline.
- 1.32 Contractor shall be responsible for the complete provision and installation of all components as specified herein. The Contractor shall provide all tools, equipment, fixtures, appliances, ancillary piece parts and hardware as necessary to complete the assembly and installation as requested. The Owner's Representative may conduct scheduled or unscheduled inspections of the Contractor's work at any time during construction. All work included in the scope assigned to the Contractor that is associated with this project shall be accomplished in a workmanlike manner, installed and assembled plumb, level and square. The product shall be delivered to the Owner finished complete, and ready to operate according to the manufacturer's specifications.
- 1.33 All installation work shall be completed to the standard of the samples approved by the Owner's Representative during the submittal process. Any products not installed to the quality detailed in these specifications and approved in the submittal process shall be reworked by the Installer to the satisfaction of the Owners Representative at no additional cost to the Owner.
- 1.34 Products as manufactured by "Extron" have been specified to coordinate with an existing facility and other contracts to be issued for this project. Alternate products will not be approved.

SEISMIC ANCHORING

- 1.35 All sound systems, A/V equipment or enclosures shall be anchored to the structure. Where details have not been provided on the drawings, anchorage shall comply with CBC Section 1632A and Table 16-A0. The Contractor shall submit drawings signed by the Contractor's registered structural engineer indicating method of compliance prior installation.

CLEANUP

- 1.36 In addition to cleanup specified under other sections, thoroughly clean all parts of the equipment. Where exposed parts are to be painted, thoroughly clean off any spattered

construction materials and remove all oil and grease spots. Wipe the surface carefully and scrape out all cracks and corners.

- 1.37 Use steel brushes on exposed metal work to carefully remove rust, etc., and leave smooth and clean.
- 1.38 During the progress of the work, keep the premises clean and free of debris.

GENERAL COORDINATION

- 1.39 The A/V drawings may reference components by manufacturer which conflict with the written specification requirements, where this occurs the written specifications shall be followed.
- 1.40 The 27 20 00 Contractor shall actively coordinate all power requirements for the Audio-Visual Systems with the Division 26 Electrical Contractor. The 27 20 00 Contractor shall coordinate the placement of the electrical outlets and hard-wired power connections at projectors, AV Systems cabinets and other equipment, with the Division 26 Contractor to determine the exact placement of the power. Outlet placement in many of the applications is critical to the space requirements and power cord length of the equipment or devices being installed.
- 1.41 Warranty: All components and installation, shall be warranted by the Manufacturer to the School District for a period of **2-years** after District acceptance and sign-off of the completed system. With the exception of the following equipment that shall be provided with longer warranties as noted;
 - 1.41.1 **Provide a (3) three year warranty for all projectors provided for the project.** Provide additional warranty coverage if the projector is not already warranted for at least three years by the manufacturer. Contractor warranty is not considered equivalent to a manufacturer warranty.
 - 1.41.2 **Provide a (3) three year warranty for all Commercial Flat Panel Monitors provided for the project.** Provide additional warranty coverage if the Commercial Flat Panel Monitors is not already warranted for at least three years by the manufacturer. Contractor warranty is not considered equivalent to a manufacturer warranty.
- 1.42 Contractor shall provide a spreadsheet for the District provided asset tags for all newly installed AV equipment. Contractor shall provide the populated tag list at the end of the projector as part of their turn-over documents.
- 1.43 Contractor shall coordinate assignment of ALL installed IP addressable equipment. The District will provide a list of available IP addresses based of Contractors device count. Contractor shall provide a spreadsheet containing the IP and MAC addresses as well as each particular device location. This list shall also contain the Switch Port Number, and Label Description.

1.44 See the example below:

Room #	Device	IP (Static)	MAC	WallJack Label	Switch #	Switch Port		IDF#
								Switch # - (From top to bottom - 1,2,3, ...- use A,B,C.. in label) Switch Port - (1 - 48)
2014	Extron	10.63.155.159	0000.0322.a32b	A1-A04	1	4	Example	IDF A1 -- Top Switch (A) -- Port 4
123	Extron	10.63.155.152	0000.0322.aabb	C1-B24	2	24	Example	IDF C1 -- 2nd Switch down in stack (B) -- Port 24
2201	Cisco AP	dhcp	0012.aaaa.12ab	A2-C35	3	35	Example	IDF A2 -- 3rd Switch down in stack (C) -- Port 35
2202	<device>	dhcp	0012.aa4a.12ab	A2-C36	3	36	Example	IDF A2 -- 3rd Switch down in stack (C) -- Port 36

PART 2 — PRODUCTS

General Classroom Audio-Video Requirements:

- 2.1 The Contractor shall refer to the Audio/Video Patch Cable section of this specification for the descriptions of the type and style of patch cable to be furnished for the different Audio-Visual and data patch cable connections. Patch Cable Section includes the different requirements for cable runs based on length and style of connector. HDMI cables shall be furnished as outlined in this section and based on the length of the cable, the model of HDMI cable required will vary. Individual patch cord specifications are not shown in the room system descriptions, only the type of cable required will be shown.
- 2.2 Contractor shall furnish and install all Audio-Visual system components as shown in the A/V system details and these specifications. Refer to the Audio-Visual System Diagram for additional information. The drawing details and specifications shall be considered as one overall document. Contractor shall provide all systems as complete turn-key operational Audio-Visual systems.
- 2.3 Provide installation of projectors with audio/video components and all local wiring. Projectors shall be located per the drawings and specifications.
 - 2.3.1 Projectors shall be furnished and installed by the Contractor. Coordinate exact model or manufacturer to be used to insure compatibility with A/V system drawings.
- 2.4 Each Classroom AV System shall be furnished with a Projector at the front of the classroom in the location shown on the floor plans. The Projectors shall serve at the presentation location within the classroom for all video. The Projector will be connected to the Classroom AV Switch in the AV Enclosure. All audio will be routed to the system speakers.
- 2.5 Provide installation of projectors with audio/video components and all local wiring. Projectors shall be located per the drawings and specifications.
 - 2.5.1 Projectors shall be furnished and installed by the Contractor. Coordinate exact model or manufacturer to be used to insure compatibility with A/V system drawings. Digital projectors must be able to fill, per the manufacturer's recommended image size at 100% of all projector performance capabilities, a 119" diagonal screen (16:9 aspect ratio). Throw distance shall not exceed 54"

from the surface of the projection screen. Projectors shall be the non-interactive type. Projector installation based on specific projector throw distance from the screen and design is based on the Optoma Model ZH406STx projector. Contractor shall coordinate with the Construction Manager for changes to the final throw distance for the fixed throw projector selected from the Lump Sum Allowance.

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2.5.2 **Provide lump sum of \$78,000 for the purchase of (13) short throw, non-interactive laser digital projectors.** Lump sum amount shall cover projector and lens invoice cost only plus tax. Shipping, contractor mark-up, profit and overhead, installation & programming set-up, and all mounting hardware, labor costs and demonstration shoot out shall be included as part of the contractor bid and not part of the lump sum. Actual make and model of projectors will be determined prior to installation and shall be approved by the Project Engineer prior to purchase.

2.5.3 Prior to purchase of the projectors, Contractor shall submit an itemized spreadsheet to the Project Engineer, Architect, Construction Manager and District Project Manager for the projectors being proposed for purchase including the following information; Make, Model, Lumen Output Rating, Native Resolution, Lens Model and Throw Ratio, Invoice Cost and Tax. The proposed projector submittal shall include manufacturer cut sheets for each type and size of each model submitted, with proper part numbers highlighted. Each type of proposed projector shall be submitted with a copy of the projector calculator showing the foot lambert rating for the image on the 119" screen. The spreadsheet shall be provided to the Construction Team a minimum of 12 weeks prior to the first proposed purchase date to allow enough time for approval, purchase and delivery of the projectors. The Contractor shall not proceed with purchase or warehousing of the equipment without written approval.

2.6 Provide installation of projection screens for the Classroom Audio-Visual Systems. The projection screens will all be electric type screens and shall be furnished with the optional Wireless RF Remote Control. Installation shall include all low voltage connectivity and power requirements. Projection screens shall be located per the drawings.

2.6.1 Contractor shall provide all hardware and structural support including, but not limited to, channel strut, brackets and hardware. Power shall be furnished by the Division 26 Contractor. All screens must be installed to comply with local codes and Zone 4 Seismic requirements.

2.6.2 All new projection screens will require a structural support mechanism to the building structure. The basic requirements will be shown in the detail drawings, but the exact requirements must be field verified by the Contractor. Contractor shall refer to the drawing details for the type of structural support system to be provided based on the type of screen used and the building conditions. The Contractor shall furnish and install all support.

2.6.3 All screens shall be electric tab-tensioned. Coordinate the screen's location with the installation of the projectors. The location of both the projector and screen

must be properly coordinated to insure the proper image size and orientation. Projector and screen locations shown on the floor plans are diagrammatical. Exact locations must be field verified by the Contractor prior to the installation of either component

- 2.7 **Provide each Classroom AV System with an RF-based Extron Voicelift Pro Voice Amplification System.** Provide each system with (2) pendant hung microphones, Model #VLM 3002. Each system shall be connected to the PoleVault switch in the AV Enclosure location. Provide RF sensor with system installed in the Audio-Visual system enclosure. See A/V diagrams for additional requirements.
- 2.8 Provide each Classroom AV System with an ADA Assistive Listening System Transmitter. Receivers shall be provided as detailed in the specification's ADA Assistive Listening System Receivers and Spare Parts Section. Provide system components as manufactured by Listen Technologies or approved equal.
 - 2.8.1 Each classroom shall be furnished with an ADA transmitter at the front of the classroom, unless otherwise shown. The transmitter shall be connected to the line level output from the AV switcher. Provide the audio cable connection from the AV Switch to the ADA Transmitter. The ADA transmitter shall be provided for each Classroom AV System.
 - 2.8.2 Install the ADA system IR Radiator at the front of the classroom just below the accessible ceiling. Mount radiator securely to the wall and aim for proper coverage of the room. Refer to the manufacturer's installation instructions for additional information. Set the transmitter for the proper frequency and set the level output as shown in the manufacturer's instructions. Provide (1) Stationary IR Transmitter/Radiator Combo – Model LT-84-01 for each Classroom AV System.
- 2.9 Document Camera, Computer and Monitors units shall be furnished by the District and installed by the District.
- 2.10 Provide Extron Global Configurator Plus and Global Configurator Professional software to be used to program all system components and all of the different types of systems installations. The Contractor shall include programming of all assets in each room system and the entire school site controls into the software from the central server location. The programming shall include assigning IP addresses, coordinate all IP addresses with the District IT Department.

Standard Classroom Audio-Video Requirements:

- 2.11 Classroom Audio-Visual Systems shall be provided for the Standard Classroom spaces in the new Classroom Addition Building. Contractor shall furnish and install all system components as shown in the A/V system details and specifications. Provide Extron Digital PoleVault Audio-Visual System. Refer to detail drawings and diagrams for exact installation configuration and required parts.

2.12 Short Throw Projector shall be placed in the following manner to ensure the proper distance from the screen surface; 1) Projector must be positioned in the center of the surface area and 2) the image shall fit the screen size exactly at the proper aspect ratio. Coordinate with other trades and the Project Engineer to insure proper placement of the projector.

2.12.1 Projectors shall be furnished and installed by the Contractor. Short throw projectors must be able to fill a 119" diagonal screen or surface (16:9 aspect ratio) from a distance not greater than 80" from the surface. Projectors shall be a non-interactive type. Contractor shall be responsible for furnishing and installing the all software, tools and control systems as required by the manufacturer for proper operation. Each of the projection systems must be properly calibrated during the installation process to allow for the images and inputs to be presented properly.

2.12.2 **Special Set-Up and Testing Requirements** - Contractor shall provide installation of the specified projectors, so that the image shall fit the screen's designated image area and aspect ratio, without the use of the keystone (0% keystone requirement), image shift (Vertical and Horizontal) and zoom functions, or modification of the calibration settings. The image shall not be artificially manipulated to allow the image to fit the screen due to the placement of the projector mount or projector.

2.12.3 **Projector must be installed level.** The projector may not be tilted to achieve the proper image area throw coverage on the screen or use manual shift/keystone functions on the projector to compensate for the distortion caused by the projector being tilted. The Contractor must use the correct length pole on the mount to achieve the proper image throw, regardless of the pole provided with the ceiling mount kit. Contractor shall be responsible for determining the correct length 1-1/2" NPT pole prior to installation of the projector.

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2.13 Teacher's interface wall plates; Each classroom shall be furnished with (2) "Local Origination" Input AV Wallplate locations (LO). The Teacher's PC will serve as the main interconnection device to the system. There will be a Teacher's Main Input and a Secondary Input location in each Classroom. Provide all patch cables for the system. See Classroom A/V diagrams for Input Wallplates and other system component requirements. Provide the following interfaces at the Teacher's wallplates;

2.13.1 Provide (2) dual HDMI input digital wallplate at the Teacher's and Secondary Interface (LO) locations (See AV Diagram); Each Input AV Wallplate shall provide a total of (2) separate HDMI inputs to the Digital Polevault Switch. See the A/V diagram for wallplate requirements. Provide (2) Extron PVT HDMI Decora Style Input Wallplates.

2.13.2 Wallplates shall be white in color, unless otherwise noted, Extron Decora style, with color matched screws. The wallplate requires a dual gang box and trim ring. The input wallplate shall be furnished with a 4-Port data outlet furnished by the 27 10 00 Contractor. Coordinate with the 27 10 00 Contractor for data requirements.

- 2.13.3 Contractor shall provide a single Extron Cat-X cable from each wallplate to the PoleVault switch in the Ceiling AV Enclosure. No other cable will be considered equal.
- 2.13.4 Contractor shall furnish and install (2) 12-foot HDMI patch cables at the Main Teacher's Interface wallplate. All HDMI patch cables shall be factory manufactured. Contractor shall provide patch cable connections to the Teacher's PC/Laptop and Document Camera from the wallplate. Refer to patch cable section for requirements.
- 2.14 Provide Extron Model MLC Plus 200 Control Panel, designated with an (LC) Local Control symbol on the drawings.
 - 2.14.1 MLC Control Panel shall be connected to the 12VDC power supply at the AV Enclosure location, a relay connection for the electric screen Up/Down functions and an RS-232 connection from MLC Control Panel to the ceiling mounted projector.
 - 2.14.2 Provide (1) Category-6 patch cable from the AV Switch in the ceiling enclosure to the MLC Plus Control Panel location in the classroom where shown on the floor plans. Provide length of patch cable as required. Patch cable lengths over 25 feet must be constructed of solid conductor cable. Stranded conductor cable will not be accepted. All cables must be factory manufactured. Field constructed or modified cables will not be accepted. Refer to patch cable section for requirements.
 - 2.14.3 Program Teacher's PC or Laptop Computer to show a quick link on screen for emulation of the MLC Control Panel buttons and functions. Teacher shall be able to control input access and screen functions from either the Control Panel or the PC/Laptop. Teacher shall be able to access the control panel function with a single APP quicklink.
 - 2.14.4 Designate buttons on MLC Control Panel for both HDMI inputs. Inputs shall be labeled as follows; HDMI Input #1 – Computer 1, HDMI Input #2 – Document Camera. All inputs on the wallplates shall be labeled with the same designations as shown on the MLC Control Panel. Confirm all labeling requirements with the District IT Department prior to installing the MLC Control Panels.
- 2.15 Contractor shall provide a ceiling mounted audio-visual enclosure for the rooms with an accessible ceiling. Provide Extron Digital PVS 407D IP 4-Input switcher/amplifier in the ceiling mounted enclosure. The components do not have to be plenum rated or the enclosure sealed, as the ceiling is not a plenum environment. The Ceiling enclosure, Model #PVM 220, shall be installed in the accessible ceiling at the location shown on the floor plans. Confirm typical placement of the enclosure with the Project Engineer prior to installation of any AV cabling.
 - 2.15.1 Each ceiling enclosure will be provided with a 3-port data outlet on a 4-Port surface jack inside the enclosure by the 27 10 00 Contractor. Coordinate location of the data outlet with the 27 10 00 Contractor.

- 2.15.2 Provide 6-outlet surge suppressor at each AV enclosure for power connections inside the enclosure. Provide Cyber Power Model #CSB600WS or approved equal.
- 2.15.3 Each enclosure shall be hard-wired with power connection by the Division 26 Contractor. Coordinate the location and electrical connection with the Division 26 Contractor.
- 2.15.4 All of the enclosures will house the AV switcher as well as the power supply for the ADA Assistive Listening System Transmitter, WePresent Interactive Device, MLC Control Panel and IP-Page Controller device. The Contractor may elect to provide a 12DVC Power Supply Brick in lieu of separate power supplies inside the enclosure.
- 2.16 Provide (1) 2-foot long, Category-6 patch cable from the data outlet in the enclosure to the input Ethernet Port #1 on the AV switch. The incoming network connection must be connected to Ethernet Port #1 on the AV Switch. Color of patch cable TBD by the District IT Department. Refer to patch cable section for patch cable requirements.
- 2.17 Contractor shall furnish and install (1) HDMI cable from the PoleVault switch to ceiling mounted projector. All HDMI patch cables shall be factory manufactured. Contractor shall provide length of cable as required. Refer to patch cable section for patch cable requirements.
- 2.18 Extron Model #FF120 Flat Field ceiling speakers shall be furnished in rooms with accessible ceilings. Standard classrooms are to be provided with (4) speakers. Confirm quantity of speakers as shown on the floor plans for each room. Color of speakers shall be white.
 - 2.18.1 Speakers shall be provided with a minimum 18AWG speaker wire to the AV switch or Amplifier.
- 2.19 Provide Interactive Collaboration Device above ceiling mounted AV Enclosure. Provide Velcro ties and sticky back holders for the attachment of the interactive device to the top of the enclosure. Classroom Audio-Visual System design based on the use of a WePresent Interactive Collaboration device. Final device choice will be made by the District IT Director.
- 2.20 **Provide lump sum of \$11,000 for the purchase of (13) Interactive Collaboration Devices.** Lump sum amount shall cover Interactive Collaboration Device invoice cost only plus tax. Shipping, contractor mark-up, profit and overhead, installation & programming set-up, all mounting hardware and labor costs shall be included as part of the contractor bid and not part of the lump sum. Actual make and model of Interactive Collaboration Devices will be determined prior to installation and shall be approved by the District IT Director and the Project Engineer prior to purchase.
 - 2.20.1 Interactive Collaboration Device HDMI video output shall be routed to one of the direct HDMI inputs on the PoleVault Switch. The audio output shall follow the video through the HDMI port to the AV Switch. Program system to allow audio

to follow the video from the Interactive Collaboration Device. Provide a high-speed HDMI patch cable for the video output from the Interactive Collaboration Device to the AV Switch. All HDMI patch cables shall be factory manufactured. Contractor shall provide length of cable as required. Refer to patch cable section for patch cable requirements

- 2.20.2 Provide (1) 4-foot long, Category-6 patch cable from the data outlet in the enclosure to the Interactive Collaboration Device. Color of patch cable TBD by the District IT Department. Refer to patch cable section for patch cable requirements.
 - 2.20.3 The Interactive Collaboration Device shall be set-up to allow for users to access the system remotely. Each system shall be set-up with a different access code each time the system is initiated. Contractor shall be responsible for programming the access of the Interactive Collaboration Device from the Control Panel.
 - 2.20.4 Separate Training for use of the Interactive Collaboration Device shall be provided to the High School Teaching Staff set to occupy the classrooms. The Contractor shall allow for a separate training service from the overall training requirement, for the operation of the Interactive Collaboration Device capabilities. Coordinate with the High School's Administration and Staff to schedule the training. Provide a minimum of 4-hours training for a minimum of (10) Staff Teaching Personnel. Contractor may be required to provide training in multiple sessions to accommodate all of the Teachers. Provide the number of training sessions as required to train all of the Teachers scheduled to occupy the classrooms in the new building.
- 2.21 Provide each Classroom AV System with an Extron Voicelift Pro Voice Amplification System.
- 2.21.1 Provide Microphone RF Receiver Model #VLR302 with system installed in the Audio-Visual System ceiling enclosure adjacent to the Projector at the front of the classroom. Provide each system with (2) pendant hung microphones, Model #VLP 302 with charging base Model #VLC302. Charging Base shall be provided at the Teacher's Desk location in each classroom.
- 2.22 Provide electric front projection, tab-tensioned screen at the front of the classroom where shown on the drawings. Contractor shall provide all hardware including, but not limited to, beam clamps, hardware, support systems and mounting brackets. The projection screen shall be mounted recessed above the accessible ceiling.
- 2.22.1 **Wall mounting the screen case below the ceiling shall not be accepted as an alternate mounting method.** The screen case must be mounted above the ceiling using the ceiling trim kit.
 - 2.22.2 Coordinate the screen location with the installation of the projector. Screen shall be mounted to allow for the projector to be mounted with the proper image drop of the screen's usable image area or with a drop as recommended by the

manufacturer's throw calculator. Screen must be aligned with projector to create the proper image size and orientation.

2.22.3 Mount screen to the structural members of the ceiling area above the screen. The structural support members are above the screen in the accessible ceiling. Additional structural support shall be furnished and installed by the Contractor. The support of the screens may require a unistrut support system to be constructed or additional bracing members to be installed between the building support members. Contractor to field verify the exact conditions prior to installation of the screen.

2.22.4 The electric projection screen shall be furnished with the Draper Optional Ceiling Opening Trim Kit. Refer to the Ceiling Opening Trim Kit installation instructions from the manufacturer and the detail drawings for complete installation requirements.

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2.22.5 Draper Model "Premier" electric tab-tensioned projection screen, 58" High by 104" Wide by 119" Diagonal at 16:9 aspect ratio loaded with front projection screen surface by Draper Model "TecVision XT1300X" with a 1.3 Gain and 180-Degree Viewing Cone.

2.22.6 Provide black out drop at the top of the screen as required to allow for the proper image size and location. The amount of black out drop used at the top of the screen may not exceed 12". Field verify dimensions and black-out requirements prior to ordering the screen. Image area shall begin at the top of the screen, based on the throw coverage of the projector. The actual quantity of screen drop required for viewing shall be adjusted and pre-set to drop the exact same distance each time the screen is activated. All screens must have the preset distance for the blackout area set for both the RF Remote Control and MLC Control Panel operation.

2.22.7 Provide RS-232 Low Voltage Control module option for remote control of the screen from the PoleVault switch. Provide cabling from the screen control module to the MLC Control Panel location in the classroom. See the floor plans for further information. The screen shall be controlled from the MLC Control Panel or from the Extron APP. Provide programming and wiring connections to allow for screen up/down, on/off controls from the MLC Control Panel. Provide Draper Model LVC-IV Control Module (In Screen Case). Module shall extend the length of the screen case per manufacturer's specifications.

2.22.8 Provide any additional items as shown on the A/V wiring details and diagrams

Classroom VoiceLift Pro Amplification System Spare Parts

2.23 Provide the following spare parts for the Voicelift systems for the classrooms;

2.23.1 Provide (1) spare RF Microphone Receivers, Model #VLR 302

2.23.2 Provide (2) spare pendant hung microphones, Model #VLP 302

- 2.23.3 Provide (8) spare ‘AA” NiMH 2400 mAh rechargeable batteries
- 2.23.4 Provide (2) spare Dual Charging stations, Model #VLC 302.
- 2.23.5 Deliver all microphones and components to the School District Facilities Department. Contractor shall be required to produce a signed copy of the materials receipt by the District Facilities Director or the District Project Manager.

ADA Assistive Listening System Receivers and Spare Parts

- 2.24 The new Classroom Building shall be provided with a set quantity of ADA receivers to be shared among all classrooms. Provide the following quantities of receivers and accessories for new Building Classroom Section;
 - 2.24.1 Provide a total of (8) IR Lanyard 4-Channel Receivers, Listen Technologies Model LR-5200-IR-P1 Receivers with integrated neck loop/lanyard and universal ear speakers for each section. Receivers shall be furnished with Lithium Ion battery.
 - 2.24.2 Provide (3) Signage Kits – Model LA-304 Assistive Listening Notification Signage for each section. The signage shall be installed at each of the common entrance areas to the classroom building. Coordinate the exact placement of the signs with the District IT Director and the Architect.
 - 2.24.3 Provide (1) Intelligent 12-Unit hard sided charging/storage case – Model LA-380, for charging and storage of the receivers, ear speakers and neck loops.
 - 2.24.4 Deliver Charging Case and all components as a complete set to the School Administrative Department. Contractor shall be required to produce a signed copy of the materials receipt by the High School Principal or the District Project Manager.
- 2.25 Provide the following quantities of spare ALS receivers and accessories for the Classroom Audio-Visual Systems included in the Section 27 20 00 specification. Spares will be delivered with the rest of the system components;
 - 2.25.1 Provide (5) Lithium Ion spare rechargeable batteries, Model LA-365.
 - 2.25.2 Provide (2) Signage Kits – Model LA-304 Assistive Listening Notification Signage.
 - 2.25.3 Contractor shall be required to produce a signed copy of the materials receipt by the District Facilities Director or the District Project Manager.

Active Flat Panel Monitor System Requirements

- 2.26 Single Input Active Flat Panel Audio-Visual System – Provide installation of Flat Panel Audio-Visual Systems with audio/video components and all local wiring. Flat Panel Audio-Visual Systems shall be located per the drawings and specifications. Refer to the drawing details for the AV System Diagrams and refer to the floor plans for the rooms to be provided with each type of system.
- 2.26.1 Provide Active Flat Panel System in the Break-Out Space Room #110. The flat panel systems shall be furnished with an HDMI input wallplate, an HDMI output wall plate, a data outlet connection and MicroPC device.
- 2.26.2 Provide Ceiling Mounted Speakers in the room where shown on the floor plans. Provide the following for Speaker installation:
- 2.26.2.1 (1) Extron Model #MPA-601 Mini-Amplifier mounted behind the Flat Panel Monitor. Provide audio input to the Amplifier from the Flat Panel's Main Audio Output. Connection may be a RCA Stereo or 3.5mm Audio Output based on Flat Panel Model.
- 2.26.2.2 (1) Extron Model #MBU 125 mounting bracket for the Mini Amplifier. Mount Amplifier behind Flat Panel on the wall.
- 2.26.2.3 (2) Ceiling Mount Speakers where shown on floor plans. Provide JBL Model #CT 26C/T Speakers each tapped at 30watts @ 70V.
- 2.26.2.4 Settings for all devices shall be for variable volume control.
- 2.26.3 MicroPC Computer, with included VESA mount, shall be furnished and installed by the Contractor. Refer to the detail drawings and AV Diagrams for the requirements for the AV equipment and interface devices.
- 2.26.3.1 Connect the MicroPC HDMI Video/Audio output to the Flat Panel Display. The HDMI output on the Micro PC shall be used to connect to HDMI Input #2 on the Flat Panel Display. Provide HDMI patch cable, length as required, as shown in the patch cable section of the specifications.
- 2.26.3.2 Attach the MicroPC to the rear of the Flat Panel Display with the VESA mount adapter plate. The MicroPC shall be mounted to the Flat Panel Display or wall mounting bracket with the VESA mount using the proper type bolts and nuts. Refer to the detail drawings for additional requirements. Provide VESA mount adapter for the MicroPC by Dell Model #452-BDEQ (Or Approved Equal).
- 2.26.3.3 Connect the MicroPC to the 2-Port data outlet behind the Flat Panel Display. Coordinate with the District IT Department for assignment of an IP Address for the MicroPC.
- 2.26.3.4 The MicroPC shall be programmed for access to the Campus LAN and any software or internet access as required by the District for the

Library Display. Contractor shall meet with the School Administration and the District IT Director for set-up of the computer and for access restrictions. Contractor shall submit meeting minutes to the Project Engineer and District Project Manager detailing the meeting decisions. Allow for a minimum of two man-hours for the coordination meeting.

2.26.3.5 The MicroPC wireless and Bluetooth connectivity shall be programmed by the Contractor with password protection. Coordinate all passwords and programming with the School Administration and the District IT Director. All passwords shall be recorded and included in the final As-Built drawings. Extend Bluetooth receiver as required to allow for proper operation of the MicroPC.

2.26.4 MicroPC shall be furnished with the following minimum requirements:

2.26.4.1 PC Specs: Intel i3-9100T Quad-Core Processor; Windows 10 Pro 64-Bit OS; 8GB DDR4 2666MHz Memory; M.2 128GB PCIe M.2 NVMe Class 35 SSD; Intel Wireless-AC 9560 Dual-Band 2X2 802.11ac Wireless/Bluetooth card

2.26.4.2 Connections: (1) 3.5mm Audio In; (1) 3.5mm Audio In; (2) USB 3.1 Ports (Front); (1) RJ45 Ethernet; (2) USB 2.0 Ports (1 with Smart Power on); (2) USB 3.1 Ports (Rear); (1) DisplayPort; (1) HDMI

2.26.4.3 Dell Model #KM636 Wireless Keyboard and Mouse (or Approved Equal)

2.26.4.4 Provide MicroPC as manufactured by Dell Model #OptiPlex 3070 Micro (or Approved Equal)

2.26.5 Provide an Extron DTP T HWP 4K 231 D DTP Transmitter HDMI Decora Style Wallplate for the local origination computer connection to the flat panel. See floor plans for the location of the input wallplate.

2.26.6 Provide an Extron DTP R HWP 4K 231 D DTP Receiver HDMI Decora Style Wallplate for the connection to the flat panel. Receiver wallplate shall be provided at the Flat Panel location. See floor plans for the location of the Flat Panel.

2.26.6.1 Provide HDMI Patch Cable from the Receiver wallplate location to the flat panel HDMI Input #1 location.

2.26.6.2 Provide a 3.5mm Stereo Audio Patch cable from the Receiver wallplate to the Audio Input location on the Flat Panel. The 3.5mm Stereo Audio connection shall be used for the Stand-Alone Audio input on the Transmitter wallplate.

2.27 The 27 10 00 Contractor will provide a 2-Port Category-6 UTP data outlet at the Flat Panel Display. Coordinate the data outlet location with the 27 10 00 Contractor.

2.27.1 Provide Category-6 patch cable from the data outlet to the Ethernet Port on the MicroPC behind the Flat Panel Display, length as required. Install patch cable for the network connection

2.27.2 Provide Category-6 Patch Cable from the data outlet directly to the Ethernet port on the flat panel monitor. All Category-6 UTP data outlets will be furnished by the 271000 Contractor.

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Future Distance Learning Microphone Array Requirements

2.28 Contractor shall provide the infrastructure and data for the addition of a Microphone Array to the Classroom Audio-Visual System. Provide a Ceiling Mounted 4-RU Audio-Visual Rack Enclosure for the future Microphone Array Control Components. The Ceiling Rack shall be furnished with power and data. Coordinate with the Div. 26 Electrical and 27 10 00 Data Contractor for the location of the power and data to the Ceiling Rack.

2.29 Contractor shall provide a Ceiling Mounted 4-RU Audio-Visual Rack Enclosure in each Classroom at the location shown on the project drawings. Ceiling Mounted 4-RU Audio-Visual Rack Enclosure is shown on the drawings with the symbol "AV-FSR". Future Microphone Array Control Components shall be mounted in the Rack Enclosure. The components do not have to be plenum rated or the enclosure sealed, as the ceiling is not a plenum environment. The Ceiling Rack Enclosure shall be installed in the accessible ceiling at the location shown on the floor plans. Confirm typical placement of the Ceiling Rack with the Project Engineer prior to final installation.

2.29.1 Provide Optional Type-2 Surge Protection Device for each Ceiling Rack Enclosure Model #SG-120HW. The Surge Protector shall be hard-wired into the Enclosure at the same time the Div. 26 Electrical Contractor is hard-wiring the electrical circuit to the built-in 5-Outlet Power Strip. The 27 20 00 Contractor must have the Surge Protector mounted inside the Ceiling Rack prior to the Div. 26 Contractor connecting the power circuit.

2.29.2 Each Ceiling Rack Enclosure shall be furnished with the Optional Model #CB-224RKRL Rack Rail Hardware Kit that adds (2) additional Rack Mount Spaces at the rear of the CB-224 cage for cable management and mounting of accessories.

2.29.3 Each Ceiling Rack Enclosure shall be furnished with the Optional "-S" Smart Power Module that allows the power to be remotely controlled. DO NOT set the Smart Power Module in "Energy Saving Mode" as the power may be automatically switched off without prior warning. The Optional 29CFM Cooling Fan is included with the addition of the Smart Power Module. Contractor shall install the Cooling Fan if it isn't factory installed.

2.29.4 Each Ceiling Mounted 4-RU Audio-Visual Rack Enclosure will be provided with a 2-port data outlet on a 2-Port surface jack inside the enclosure by the 27 10 00 Contractor. Coordinate location of the data outlet with the 27 10 00 Contractor.

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- 2.29.5 Each Ceiling Rack Enclosure shall be hard-wired with the power connection to the 5-Outlet Power Strip and Surge Protector by the Division 26 Contractor. Coordinate the location and electrical connection with the Division 26 Contractor.
- 2.29.6 The Ceiling Rack will house the future Microphone Array Controller, Media POE Switch, Digital Signal Processor (DSP), IP Controller or similar equipment based on the final Microphone Array System and Manufacturer. Final equipment configuration shall be determined prior to the conclusion of the project.
- 2.29.7 Provide FSR Inc. Support Cable Installation Kit #CB-MNT1 for each Ceiling Rack Enclosure for the splayed wire supports from each corner of the Enclosure to the Deck above.
- 2.29.8 The Contractor shall furnish and install the Ceiling Rack Enclosure to the structural members above in ceiling or to the deck above depending on the availability of structural members. The support of the Rack will require the provision of a Unistrut with a threaded rod support system. The structural support members are above the ceiling area are as shown in the Architectural drawings. The support of the Rack will require a Unistrut support system to be constructed or additional bracing members to be installed between the beams or framed members. Contractor to field verify the exact conditions prior to installation.
- 2.29.9 Provide Ceiling Mounted 4-RU Audio-Visual Rack Enclosure as manufactured by FSR Inc. Model #CB-224S with Optional Upgrades as specified.
- 2.30 Provide Microphone Array Classroom Audio Systems in Ceiling Mounted Rack Enclosure. Microphone Array Classroom Audio System design based on the use of a Biamp Tesira Forte AV Switch, TesiraConnect Controller and Parle Microphone Array devices. Final device choice will be made by the District IT Director.
- 2.31 **Provide lump sum of \$110,500 for the purchase of (13) Microphone Array Classroom Audio Systems.** The Microphone Array System will be added to the Extron PoleVault Classroom Audio-Visual System. Lump sum amount shall cover Microphone Array System Equipment and Devices and pre-terminated Audio Cables invoice cost only plus tax. Shipping, Contractor Mark-Up, profit and overhead, installation & programming set-up, all mounting hardware and labor costs shall be included as part of the contractor bid and not part of the lump sum. Actual make and model of Microphone Array Classroom Audio Systems will be determined prior to installation and shall be approved by the District IT Director and the Project Engineer prior to purchase.
- 2.32 Microphone Array Classroom Audio Systems output shall be routed to the 7th Audio Only Input on the PoleVault Switch. The audio input to the PoleVault switch shall be fully mixed for a single audio output from the AV Switch to the Classroom or Remote Attendees. Final design configuration and any additional equipment will be determined by the final products chosen. Contractor shall base bid requirements on Biamp's Tesira Systems.

Courtyard Sound System General Requirements

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- 2.33 The Contractor shall refer to the Audio/Video Patch Cable section of this specification for the descriptions of the type and style of patch cable to be furnished for the different Audio-Visual and data patch cable connections. Patch Cable Section includes the different requirements for cable runs based on length and style of connector. Individual patch cord specifications are not shown in the system descriptions, only the type of cable required will be shown.
- 2.34 Contractor shall furnish and install all Audio-Visual system components as shown in the A/V system details and these specifications. Refer to the Audio-Visual System Diagrams for system requirements for additional information. The drawing details and specifications shall be considered as one overall document. Contractor shall provide all systems as complete turn-key operational Audio-Visual systems.
- 2.35 Provide installation of individual speakers for the Courtyard Sound System. The speakers shall be mounted horizontally on the column with manufacturer recommended support U-Brackets as shown in the detail drawings. Speaker shall be mounted at the height shown on the floor plans and detail drawings. The support bracket shall match the hole pattern of the speaker. Coordinate the proper bracket with the speaker prior to ordering. Contractor shall provide all hardware including wall mount brackets, safety cables, stainless-steel hardware for outdoor installation and anchoring systems. Speakers must have the ability to be adjusted to be aimed to adjust the speaker coverage.
- 2.36 Provide Sound System with an ADA Assistive Listening System Transmitter. Receivers shall be provided as detailed in the specification's ADA Assistive Listening System Receivers Section. Provide system components as manufactured by Listen Technologies or approved equal.
 - 2.36.1 RF- Based Transmitter System - Install the ADA system RF Transmitter in the Sound System Cabinet. Mount antenna for transmitter securely to the Outside of the Elevator Shaft wall and test for proper coverage of the area. Refer to the manufacturer's installation instructions for additional information. Provide RF-Based transmitter and receivers as shown in the specifications.
- 2.37 Contractor shall allow a minimum of 4 hours of meeting time with School Staff and shall provide meeting minutes of the system requirements and events that transpired during meetings Contractor shall prepare 3-4 templates with written instructions that can be given to the school noting the settings and levels on the Digital Mixer for events such as; Assemblies, Basic Presentations, and Background Music. Meet with School Administrative Staff to determine the types of templates required. Templates shall be a representation of the Mixer and Output Settings from the programming pages in a three-ring binder to be kept in the Administrative Office. Pages shall be laminated.
 - 2.37.1 Contractor shall provide Mixer presets from both the DSP/Mixer App and the Extron TLC Control Panel.
 - 2.37.2 Audio output frequency levels from the Mixer for each type of preset, shall use the baseline established from the SmaartLive testing. The baseline will establish

a starting point for each level at the varying frequencies. The Contractor shall set the levels based on the application. The DSP settings shall be set in conjunction with the preset applications on the mixer.

- 2.37.3 The Contractor shall contact Extron for the control codes to enable the ability to activate the presets from the TLC Control Panel. The Control Panel shall be programmed with easy to follow, simple step-by-step pages that activate and disable the mixer and AV matrix switch page or event settings. Once the preset is selected from the Control Panel, the User shall not have access to the mixer controls from the TLC Control Panel, only the event presets and the standard control buttons used for every event.
- 2.38 Contractor shall provide commissioning of the Courtyard Sound System. Provide test equipment and an operator to perform system commissioning. Commissioning will include equalization of speaker system to compensate for acoustics and setting, including but not limited to equalization, delay, level, limiting, and crossover frequencies. Test equipment must include a minimum of SmaartLive V8 or approved equivalent running on a software manufacturer approved computer, an Earthworks M30 calibrated measurement microphone or approved equivalent, and a Sound Devices USB Pre-microphone preamp or approved equivalent. Contractor's operator must have attended a factory training class for the DSP software used on the project. Operator must also have attended a minimum of one (1) factory training session in the use of SmaartLive software.
- 2.39 Contractor shall provide and install all audio wiring and components required per the detail drawings and specifications. Contractor shall provide all necessary cables and connectors for routing of the audio to the Mixer.
- 2.40 All patch cables furnished by the Contractor shall be provided as outlined in the Patch Cable Section of the specifications. The patch cables shall be provided based on length and type of application. Contractor shall furnish exact quantities of the patch cables to be provided with the submittals prior to the beginning of installation of the Audio-Visual systems.
- 2.41 The Contractor shall provide all individual Sound System hand-off components (microphones, charging bases, spare batteries, extra patch cables, etc.) for the Courtyard Sound System to the Site Principal. The components shall be individually bagged up, identified with the Poll Name, boxed up and delivered to the Site Principal. The Principal shall deliver the system components to the designated storage location for the Courtyard Sound System.

Courtyard Sound System Requirements

- 2.42 Provide a Sound System for the Courtyard as shown in the project drawings and these specifications.
- 2.43 All system equipment shall be rack mounted in a wall mounted Equipment Cabinet in the Electrical Room #106. Refer to detail drawings for Equipment Cabinet requirements. Location of Cabinet shall be as shown on the building floor plans.

- 2.44 Provide a Pro DSP/Mixer Audio router and processor with AEC and Dante for distribution and control of audio signals for the Courtyard Sound System. Provide a 12 DSP Input Channels with AEC X 8 Output Channels Audio Digital Matrix Processor by Extron Model DMP 128 Plus C AT with AEC & Dante in the Sound System Rack.
- 2.44.1 The ProDSP Matrix Processor shall be provided with a POE Powered Ethernet Switch data connection from the 27 10 00 Contractor at the wall mounted rack. Provide a 3-foot Category-6 UTP patch cable from the ProDSP Matrix Processor to the data outlet in the wall mounted rack. Coordinate with the District IT Department for the POE Switch Port from the IDF location.
- 2.44.2 DSP Input Channels: Audio Input Channels to ProDSP Matrix Processor shall be routed from the following audio inputs: (2) Hard-wired Microphone Outlets, (2) Wireless Microphone Receivers, (1) Audio Only Stereo Input from the Exterior Wallplate on the Elevator Shaft #113 and (1) Wifi/Bluetooth Receiver in the Sound Cabinet. Refer to the specifications and Courtyard Sound System AV Diagram for each individual device input for additional requirements.
- 2.44.3 DSP Output Channels: Provide audio output channels from the ProDSP Matrix Processor to the Amplifiers. Audio outputs from ProDSP Matrix Processor shall be routed to the Amplifier in Five (3) Channels. A total of (2) channels will be directly wired to the 4-Channel Amplifier; (2) in Stereo (L/R) for Main/Fill Wall Mounted Speakers; (1) to the ADA Transmitter. Refer to the Courtyard Sound System AV Diagram for additional requirements.
- 2.44.4 Provide fixed line level audio output to the RF-Based ADA Assistive Listening Systems Transmitter mounted in the Sound Rack. The audio level shall be set flat to allow the users to control volume on the receivers.
- 2.44.5 The ProDSP Matrix Processor via the ProDSP software shall be used to set the routing and equalization of all of the audio inputs/outputs. The Contractor shall balance each individual input and output to provide optimum signal quality. The Music Type Presets on the Control Panel shall each be set with individual EQs to match the music or audio type chosen.
- 2.44.6 System shall be provided with Extron's ProDSP Configurator Software for management of the complete sound system. Contractor shall provide all programming and software and shall provide the District with all software presets. Set Administrator Password access to prevent inadvertent changes to the programming after the installation.
- 2.44.7 System shall be programmed with music reproduction pages that represent different EQ levels for different styles of music. Provide buttons or pages on the control panel with a selection of music types and Announcement; Rock, Hip-Hop, Rap, Classical, Pop, Voice for Announcements, etc. with EQ settings for that type of sound. The exact requirements shall be determined by the interview with the District Staff and Project Engineer. Contractor shall provide a system programming matrix to be submitted to the Project Engineer for approval prior to final programming.

- 2.45 Provide a Wireless Wifi and Bluetooth Audio Streaming Receiver/Pre-Amp at the Sound Cabinet for Local User Input from a handheld device (Smartphone, Tablet, iPod, etc.) or wirelessly from a Laptop Computer, streaming music from the Internet and for Internet Radio station broadcasting. Streaming and Internet functions shall be controlled from a handheld device or District furnished computer with the manufacturer's APP installed on the computer or device.
- 2.45.1 The Wireless Wifi and Bluetooth Audio Streaming Receiver's Main Unit shall be installed in the Sound Cabinet on a single 1RU shelf in the cabinet provided by the Contractor. The receiver shall be secured to the shelf using Velcro safety straps. The receiver shall be installed in the Sound Cabinet at the top, with the shelf in the highest rack unit, insures that it can clearly receive signals from the local Wi-Fi network and paired User Bluetooth devices.
- 2.45.2 Provide (2) adjustable rack shelf straps to hold the Receiver in place and secure it to the shelf. Strap must be routed around the Receiver on the sides, not on the front/back of the Receiver where they can block any connections or indicators on the equipment. Straps shall be constructed of a nylon material, a minimum of 1" wide, with a plastic snap buckle. Provide Rack Shelf Straps as manufactured by Rack Solutions Part #1USHL-STRAP (or approved equal). Since straps come 72" in length, The Contractor shall trim off all but 12" of slack after securing the equipment to the shelf.
- 2.45.3 Provide a low-profile 1RU Universal Mounting shelf in the cabinet for the Wireless Wifi and Bluetooth Audio Streaming Receiver. Strap the Receiver to the shelf. Shelf may be used for securing power supplies or other ancillary equipment in the cabinet. Provide 11.5" Deep Universal Mounting Shelf by Middle Atlantic Model #UMS1-11.5 (or approved equal).
- 2.45.4 Route the RCA L/R Stereo Audio output on the Receiver to the input terminals on the ProDSP Matrix Processor. Provide a RCA Stereo (L/R) to blunt end cable to the captive screw input terminal connection on the Matrix Processor. Set the output toggle switch to "Pre-Amp" on the output audio panel on the back of the Receiver. The toggle switch must be set on "Pre-Amp" to operate properly.
- 2.45.5 Provide IR Control cable from the Wifi and Bluetooth Audio Receiver to the TLC Control Panel in the Courtyard Office. Connect the IR Control cable to the 3.5mm bayonet style "Remote In" port on the rear of the Receiver. The "Remote In" port on the Receiver is specifically provided for remote operations. Program the TLC Control Panel with a page for full function emulation of the buttons that appear on the Remote Control provided with the Receiver. This shall include the status capability of the Remote Control that shows different colors based on the type of connection being utilized. Show some type of indicator and information on the control panel emulating indicators on the front of the receiver regarding the inputs.
- 2.45.6 Provide a Category-6 patch cable from the 4-port data outlet at the rack to the Receiver's RJ45 network port. Set the "Wireless Switch" toggle switch on the back of the Receiver to the wired LAN port position for connectivity via the

LAN network WAP installed in the Office and the Exterior WAPS in the Courtyard area. Coordinate with the District IT Department to insure that the system will allow for User Access from the APP on their wireless handheld devices. All connections shall be provided through the hard-wired LAN port.

2.45.7 Load the “Yamaha MusicCast” APP, or Apple “AirPlay” if they have an Apple iPhone, on the Instructor’s handheld device and provide training in the use of the MusicCast APP and how it is related to the exact set-up of the system for the Courtyard . Load the “Yamaha MusicCast” APP on the TLC Control Panel and provide a page on the control panel showing the APP’s options.

2.45.8 Sirius Radio via the Internet Radio function on the Wireless Wifi and Bluetooth Audio Receiver/Pre-Amp, shall be furnished with a Sirius Radio Account for full access of Sirius Radio stations and full internet access through Sirius radio’s Internet APP. Contract shall include (3) years of Sirius Radio service. Contractor shall provide account information and training for access for the Administration Staff. Set-up multiple receivers for the account Sirius Radio Account and login information. Provide training for access to the Administration Staff and Selected Instructors or other Approved Personnel.

2.45.8.1 Contractor shall provide (10) Sirius Radio station presets based on the input from the Swim Coaches and Phys. Ed. Staff and test all stations for proper operation.

2.45.8.2 Contractor shall program (10) Internet Radio stations in addition to the Sirius Radio stations based on the input from the Swim Coaches and Phys. Ed. Staff and test for proper operation.

2.45.9 Provide Wireless Wifi and Bluetooth Audio Receiver/Pre-Amp by Yamaha with IR Remote Control Model #WXC-50.

2.46 Provide Exterior Microphone Outlet with 3.5mm Audio Only Input wallplate on the Elevator Shaft adjacent the Courtyard “Auditorium”. Refer to the floor plans for the exact location of the wallplate.

2.46.1 The wall plate shall be furnished with (2) Male XLR jacks and (1) 3.5mm Female Audio Only Stereo Input. The wallplate and connectors shall be provided for full weather exposure with a gasketed lift-up cover and shall be weathertight.

2.46.2 Provide Male Outdoor rated XLR jack as manufactured by Neutrik Model #NC3MPR-HD (Or Approved Equal) in wallplate

2.46.3 Provide gasketed lift-up single gang Decora Cover Outdoor rated as manufactured by Leviton Model #4998-X (X= color)

2.46.4 Provide microphone cable and Stereo Audio cable from the wallplate to the Pro DSP/Mixer location in the Sound Rack.

- 2.46.5 Microphone jack and 3.5mm Audio Only Input shall appear on the TLC Pro Control Panel in the Office. Program Audio Only Input as “Courtyard Area” on the Control Panel.
- 2.47 Amplifier for the Outdoor Sound System Speakers - (1) 4-Channel Power Amplifier with built-in DSP Functions:
 - 2.47.1 Power Output – 1500W @ 8-Ohms per channel
 - 2.47.2 Power Output – 3000W @ 4-Ohms Bridged per Pair of Channels
 - 2.47.3 Power Output – 1500W @ 70-Volts per channel
 - 2.47.4 Pair (2) Wall Mounted Main Speakers Community IP6-1122 mounted on the Walkway Columns of the building, shall be connected to the amplifier, one per channel, at 1200 Watts @ 8-Ohms each. Total of (2) Channels for the Wall Mounted Speakers. Set limiters on Channels at 1200 Watts.
 - 2.47.5 Pair (2) Wall Mounted Fill Speakers Community IC6-1082 mounted on the Walkway Columns of the building, shall be connected to the amplifier, one per channel, at 500 Watts @ 8-Ohms each. Total of (2) Channels for the Wall Mounted Speakers. Set limiters on Channels at 500 Watts.
 - 2.47.6 Linea Research Amplifier Model #44C06 (or approved equal)
 - 2.47.7 Built-in DSP Processing Functions - Set DSP functions on the amplifier to match the Speaker ratings to the amplifier channel. The DSP functions shall be set to provide optimal performance for the Outdoor Courtyard Area. Set delays for the Fill Speakers in the Courtyard System to mitigate echo from the Main Speakers on the Buildings.
 - 2.47.8 Amplifier mounted in Main Sound System Cabinet in the Electrical Closet on the First Floor.
- 2.48 Provide wireless microphone system consisting of the following:
 - 2.48.1 Digital Wireless Combo Dual Channel Systems Package by Shure Model #ULXD4D (Or approved equal by Sennheiser). Provide Receiver with rack mount kit. All Digital Wireless System components shall be frequency matched.
 - 2.48.1.1 Provide of extension of the Antennas for both Channels “A” & “B” from the Receiver. Provide Indoor/Outdoor Rated Low Loss RG58 Antenna Cable Belden #7806A (Or Approved Equal) with minimum 19AWG Solid Bare Copper Center Conductor, 100% Duofoil Shield with 90% Tinned Copper Braid and a PE Jacket to reduce the gain loss for the Antenna extension, length as required. Cable shall have a maximum Attenuation of 10.3dB/100ft @900Mhz rated at 50 Ohms impedance. Cables shall be routed

from the Receiver to the antenna locations mounted on the exterior of the Elevator Shaft, as indicated on the drawings.

- 2.48.1.2 Provide waterproof Indoor/Outdoor-Rated (2) AKG Model #RA4000 B/EW Active Omni-Directional Antennas with Built-In Amplifier. Antennas shall have a Frequency Range of 470 to 952 MHz and Gain of 17dBi. Wall Mount Active Antennas at height shown on the drawings. Antennas shall be placed a minimum of 6-feet apart on the Elevator Shaft. Provide AKG Model #APS4 EU/US/UK/AU Antenna Power splitter with Power Supply for the Active Antennas.
- 2.48.2 Provide (2) Shure #ULXD1 Digital System Body Packs with $\frac{1}{4}$ wave antenna and frequency/power lockout. Body Packs shall be furnished with Model #SB900A Lithium-Ion battery with 9-hour battery life.
 - 2.48.2.1 Digital System Body Packs shall be furnished with (2) #WL185 cardioid (130° Pickup) lavalier microphones and (2) Model #WCM16 Headworn Electret Condenser Microphones.
- 2.48.3 Provide (2) Shure #ULXD2/SM58 Digital System Handheld Microphones with Cardioid (unidirectional) dynamic pickup pattern, On/Off/Mute Switch and frequency/power lockout. Body Packs shall be furnished with Model #SB900A Lithium-Ion battery with 12-hour battery life. Provide each Microphone with Model #A58WS Microphone Windscreen.
 - 2.48.3.1 Provide Handheld Microphones each with Model #A58WS Microphone Windscreen and Model #WA371 Microphone Clip.
- 2.48.4 Provide (2) Spare Model #SB900A Lithium-Ion batteries
- 2.48.5 Provide (1) Shure Model #SBRC Rack-Mount Battery Charger with (2) #SBC-AX Charging Modules for the Rack-Mount Battery Charger. Charging modules must be furnished with the power cables.
- 2.48.6 Microphones and Body Packs shall be provided with storage bags.
- 2.49 Provide (2) Hard-Wired Handheld Microphones with minimum frequency response of 50Hz to 18kHz. Microphone shall have on-off switch with lock "on" feature and adjustable swivel adapter.
 - 2.49.1 Provide wind screen for all microphones
 - 2.49.2 Provide (2) Shure Model #SM86 Cardioid Handheld Microphones. (Or approved equal by Sennheiser)
- 2.50 Provide (2) full height microphone stands with booms and (1) desk height microphone stand

- 2.50.1 (2) “Ultimate” Pro-T-T with telescoping boom (no approved equal)
- 2.50.2 (1) Model #JS-MMS1 Desktop Microphone Stands by Ultimate Support (no approved equal)
- 2.51 Rack Mounted Sequenced Power Control System for Sound Cabinet
 - 2.51.1 Power Switched/Sequenced outlets for complete activation and shut down control via the rack mounted controller.
 - 2.51.2 Connect the rack mounted PDU/Controller to the sequenced power control “Pods” mounted in the rear of the Sound Cabinet. See detail drawings for additional information. The Contractor shall be responsible for setting the proper sequencing for all Pods connected to the PDU/Controller and for all of the devices connected to the “Pods”.
 - 2.51.3 The “Pods” shall be connected to the PDU/Controller with an Eight-wire, RJ45 low voltage patch cable. The patch cable connections do not follow standard EIA/TIA or BICSI standards for the wiring configuration. DO NOT USE CAT-5E or CAT-6 type data patch cables for the connections from the “Pods” to the PDU/Controller. Refer to the manufacturer’s installation practices and manual to insure the proper wiring configuration to used.
 - 2.51.4 Rack Mounted PDU/Controllers; Provide (2) 19” rack mounted 120V 20-Amp PDU/Controllers with (3) sequenced duplex receptacles and (1) unswitched single receptacle on the rear of the PDU. PDU/Controller shall have a built-in circuit breaker, AC line surge protection, a multi-stage AC line filter and three event sequencing ability. PDU/Controllers shall be furnished with a 120V, 20-Amp, L5-20P input plug with 10-foot single phase power cord connection. Provide PDU/Controllers as manufactured by Juice Goose Model #CQ-1520. Plug PDU/Controllers, one each into the (2) duplex receptacles in the front of the cabinet.
 - 2.51.5 Sequenced Power Control Pod; Provide (1) sequenced power control “Pod” in the rear of the AV cabinet to provide a sequenced power connection for the amplifier. Provide (1) 120V, 30-Amp “Pod” with (1) 30-Amp twist-lock receptacle in a self-contained junction box hard-wired to a 120V, 30-Amp circuit. “Pod” shall be connected to the CPU/Controller with the low voltage control patch cable. Provide sequenced power control “Pods” as manufactured by Juice Goose Model #CQ3000 (NEMA L5-30R).
 - 2.51.6 Power Strips; Provide (1) power strip for power to the wireless microphone charging bases and LED Light. The power strip shall be plugged directly into one of the duplex receptacles so that the chargers can continue to charge, even if the rest of the system is powered down. Power strip must be mounted directly above the rack mounted shelf. The power strip shall be used as the location to plug in the LED Light for Sound Cabinet. Power strip shall be provided with a 3-year warranty. Provide (1) Juice Goose Model #JG11-20A Power Strip. Refer to the detail drawings for additional requirements.

- 2.51.7 Provide (2) 120V, 20-Amp duplex receptacles and (1) 120V, 30-Amp hard-wired 120V, 30-Amp circuit in the middle of the AV Cabinet for sound system power connections. Contractor shall coordinate with the 260000 Electrical Contractor for location of duplex receptacle and hard-wired connections to the “Pods” in the rear of the AV cabinet.
- 2.51.8 Amplifier shall be connected to the Sequenced Power Control Pod, FIRST, then Mixer and other equipment shall be connected to the PDUs and power strip. Contractor shall evenly distribute the power requirements across the PDU circuits. The small, low powered equipment such as the ADA Transmitter, Microphone Receivers, fan controller, etc. shall be connected to the power strip outlets mounted in the rear of the cabinet one the rear rack rails. Refer to the Sound System Power Diagram in the Detail Drawings.
- 2.51.9 Contractor shall furnish the Project Engineer with a detailed summary of the electrical connections to the PDU/Controller and sequencing Pods and the proposed outlet sequence to show proper delay for system start-up and shut down.
- 2.51.10 Contractor shall provide a contact closure relay cable from the First CQ-1520 Sequencer in the system to the TLC Control Panel in the Press Box for remote Power Up/Down of the Sound System from the Control Panel. Connect the cable to the Contact Closure connection on the Extron TLC PRO 726M LCD Control Panel to be used as a dry contact closure. Terminate the cable with a RJ45 modular plug, wired per the manufacturer’s installation manual instructions to the proper pins on the sequencer port on the CQ-1520. The Control Panel shall be programmed to have a page with buttons for “Sound System Power On” and “Sound System Power On.
- 2.52 Provide an Assistive Listening System furnished and installed to meet CBC Section 11B-219 and comply with CBC Section 11B-706 and the ADA requirements for hard-of-hearing. The system shall be integrated into the sound reinforcement system.
 - 2.52.1 Per ADA Assistive Listening System CBC Section 11B-706.3 – “The minimum number of receivers to be provided shall be equal to 4% of the total number of seats, but in no case less than two. 25% minimum of receivers provided, but no fewer than two, shall be hearing aid compatible”.
 - 2.52.2 Mount the transmitter in the Sound Rack. Adjust as required for total coverage of Bleacher and Outdoor Seating Areas. Antenna shall be mounted on the outside wall of the Courtyard Office where shown on the drawings. Provide Listen Technologies Model Assistive Listening System package shall include:
 - 2.52.3 (1) Transmitter – Model LT-803-072-01 with LA-122 Universal antenna kit and LA-130 remote antenna kit.
 - 2.52.4 (16) IR belt clip type 57-Channel Receiver Packages, Listen Technologies Model LR-4200-072 with (1) Li-ion rechargeable batteries, Model LA-365, for each receiver. Packages include integrated neck loop/lanyard and universal ear speaker

Model LA-401 and provision of ear buds, Model #LA-404 with the neck loop. All receivers shall also be furnished with belt clips.

2.52.5 (5) Signage Kits – Model LA-303 Multi-Lingual Assistive Listening Notification Signage. Signs shall be installed around the perimeter of the Outdoor Courtyard Area.

2.52.6 Provide (2) Model #LA-380 Intelligent charging/carrying case for storage and battery charging of the receivers.

2.52.7 Provide case with a sterilization kit of 100 wipes for the ear buds, Model # LA-902 (provide total of 5-20 count individually wrapped wipes.)

2.53 Provide (1) Wall Mounted Dual Swing Equipment Cabinet with fixed base and pivoting equipment area:

2.53.1 Height 35" x 22" overall depth (20" usable depth) x 24 width, 16RU Height

2.53.2 Provide solid front locking solid door. Match all locksets for the cabinet. Match Lockset Key for the Front Door and the Storage Drawer.

2.53.3 Dual 4-1/2" Fan Kit, Minimum 95CFM each by Middle Atlantic Model # QFAN. Provide fans with 115V Power cables and fan grilles for the top of the cabinet. Plug fans into Thermostatic Controller. Provide vent blocker kit for sides of cabinet.

2.53.4 Automatic thermostatic fan control, Model #FC-2-215-1CA

2.53.5 Middle Atlantic Rack Mount LED Work Light Model #LT-CABUTL-SINGLE mounted in the front of the rack at the top of the Cabinet. Provide LED Light with 59" Power Cord. LED Light shall be plugged into Power Strip for "Always-On" function.

2.53.6 Heavy Duty Storage Drawer by Middle Atlantic Model #D3-LK with lock set to match the lock provided for the front door.

2.53.7 Provide (2) Equipment shelves by Middle Atlantic Model # U2V (or approved equal) – For mounting of devices that do not have rack mount kits available or securing power supplies.

2.53.8 Blank panel – Middle Atlantic # SB1 – Fill in all open spaces with blank panels

2.53.9 Vented panel – Middle Atlantic # VT1 –Provide vented panels above and below each amplifier

2.53.10 Middle Atlantic # DWR-16-22PD series

2.54 Provide Extron TLC PRO 726M LCD Control Panel with Port Expansion Adapter for Local Control (Symbol "LC" on drawings) location for control of the Courtyard Sound

Reinforcement System, at the location shown on the drawings. Program a Administrative Department Designated Laptop PC, provided by the District, to show a quick link on screen for emulation of the TLC's control page functions. A Presenter or Instructor shall be able to control input access from either the TLC Pro Panel or the Laptop PC. TLC Control Panel shall be furnished in white.

- 2.54.1 Provide programming and page designs for the TLC Control Panel. Designate buttons on TLC Control Panel for all audio inputs. Inputs shall be labeled as follows; Mic Input #1/#2 – MIC #1 and MIC #2, 3.5mm Audio Only Input #3 (Courtyard Area), Wireless Mic Input #4/#5 – Wireless MIC #4 and MIC #5 and Yamaha Receiver.
- 2.54.2 Control Panel shall be provided with Control Pages for Presets based on the type of presentation function determined by the interviews with the client. Confirm all programming and labeling requirements with the District prior to installing the software changes on the Control Panel. All page designs and flow charts shall be submitted for approval to the Project Engineer and the District Project Manager prior to installation.
- 2.54.3 The Control Panel shall provide Infrared (IR) control of the Wifi/Bluetooth Receiver. Route an IR-Control Cable from the Wifi/Bluetooth Receiver to the TLC Control Panel.
- 2.54.4 The Control Panel shall provide Relay Contact Control of the Power Sequencer in the Sound Cabinet. Route a 2-Pair Unshielded Control Cable from the Juice Goose CQ-1520 Power Sequencer in the Sound Cabinet to the TLC Control Panel. The Control Panel shall be programmed to "Power On/ Power Off" the Sound System remotely using the relay contact. The cable shall be terminated on a RJ-45 Plug on the end being plugged into the CQ-1520 "Signal Input" RJ45 Port. The cable shall be connected to the first Sequencer in line for the control of the system.
- 2.54.5 The TLC Control Panel shall be furnished with the Port Expansion Adapter on the rear of the Control Panel. Connect the IR Control Cable and the Relay Contact Control Cable to the Port Expansion Adapter.
- 2.54.6 Contractor shall download and provide the Wifi/Bluetooth Receiver's User APP and the Extron DSP User APP on the Control Panel. Provide additional User APPs as required by the District. Confirm control codes with Extron Support.
- 2.54.7 Each Page on the TLC Control Panel shall be provided with "Home" Button and "Volume Control Up/Down" Button. Microphone Inputs shall be provided with Mixer Fader for control of the Mic Level Input.
- 2.54.8 Provide TLC Control Panel with Recessed Custom Backbox Extron #RWM2. The Control panel location shall not be provided with a standard junction box. The Div. 26 Contractor shall stub the conduit in the wall directly above the Control Panel location. The Recessed Wall Mount does not attach to a J-Box and must be cut into the wall. See the manufacturer's instructions for installation.

- 2.54.9 Provide a Category-6 UTP patch cable to the TLC PRO 726M Control Panel from the Sound Rack. Connect to the data outlet furnished by the 27 10 00 Contractor for a POE powered port and confirm that the port is activated at the IDF location. Coordinate the installation with the District IT Department and the 27 10 00 Contractor.
- 2.55 Provide (2) Main Wall Mounted Speakers mounted to the Vertical I-Beam Columns for the Covered Walkway outside of the building. Speakers shall be installed at the locations as shown on the floor plans. Speakers shall be wall mounted using the manufacturer recommended Outdoor Stainless Steel Wall Mount U-Brackets, Custom Channel Cantilever Tube Speaker Mount and installed as shown in the drawing details. Speakers must have the ability to be adjusted to adjust the vertical coverage, aim speakers for the angle of the desired speaker coverage. Contractor shall provide all hardware including wall mount brackets, vandal-resistant hardware, safety cables and anchoring systems. Shown on Courtyard floor plans as TYPE "A".
- 2.55.1 Passive Two-way, surface mounted loudspeaker
- 2.55.2 Mains Speakers shall be zoned separately from the Secondary Fill Speakers. The speakers shall be considered the "Mains Speakers"
- 2.55.3 Treated 12" LF Ferrite Driver with 2.5" Voice Coil
- 2.55.4 1.4" HF exit, 3" Voice Coil, Hybrid-Titanium/Polymide Diaphragm, Ferrite Compression Driver
- 2.55.5 Weather-resistant construction IP55W minimum – Grille; Marine Grade Aluminum Zinc-Rich Dual Layer Powder Coat with Treated Woven Fabric Backing: Enclosure; – 15mm PolyGlas, Grey, Heavily-Textured Industrial Grade Exterior Coating; color per District Choice. Provide Custom Color to match Exterior Finish
- 2.55.6 Power rating 1200 watts (Program) @ 8 ohms (2400W Peak)
- 2.55.7 Coverage pattern 90° H X 60° V Coverage Pattern, Rotate Horn for proper Coverage
- 2.55.8 Maximum 28" High x 14.5" Wide x 18" Deep, 65 Lbs (Without Bracket), Custom Finish
- 2.55.9 Community Model #IP6-1122/WR96 (No approved equal)
- 2.55.10 Pair of Speakers shall be connected to the Extron DMP 128 Plus in stereo, each Speaker on a separate channel
- 2.55.11 Attach Safety Cable to Speaker on one of the M10 Rigging Points on the Speaker. Attach other end to attachment bolt on Channel Cantilever Tube Speaker Mount. Refer to drawing details for additional information.

- 2.55.12 Route Speaker Cable neatly from the Junction Box to the speaker. Leave slack for future maintenance in the J-Box. Refer to the Detail Drawings for additional requirements. Speaker Cables shall be sized for voltage drop based on run length.
- 2.55.13 Speakers shall be connected to the amplifier at 1200 watts @ 8-Ohms, one speaker per channel
- 2.55.14 Refer to detail drawings Courtyard Sound System Diagram for additional information.
- 2.55.15 The speakers shall be wired with Aqua-Seal 18-AWG speaker wire to the Amplifier in the Sound Cabinet. Refer to detail drawings wiring diagram for additional information
- 2.55.16 All Exterior Hardware shall be stainless steel.
- 2.56 Provide (2) Fill Wall Mounted Speakers mounted to the Vertical I-Beam Columns for the Covered Walkway outside of the building. Speakers shall be installed at the locations as shown on the floor plans. Speakers shall be wall mounted using the manufacturer recommended Outdoor Stainless Steel Wall Mount U-Brackets, Custom Channel Cantilever Tube Speaker Mount and installed as shown in the drawing details. Speakers must have the ability to be adjusted to adjust the vertical coverage, aim speakers for the angle of the desired speaker coverage. Contractor shall provide all hardware including wall mount brackets, vandal-resistant hardware, safety cables and anchoring systems. Shown on Courtyard floor plans as TYPE "B".
 - 2.56.1 Passive Two-way, surface mounted loudspeaker
 - 2.56.2 Fill Speakers shall be zoned separately from the Mains Speakers. The speakers shall be considered the "Fill Speakers"
 - 2.56.3 Treated 8" LF Ferrite Driver with 1.8" Voice Coil
 - 2.56.4 1" HF exit, 1.75" Voice Coil, Advanced Polymer Diaphragm, Ferrite Compression Driver
 - 2.56.5 Weather-resistant construction IP55W minimum – Grille; Marine Grade Aluminum Zinc-Rich Dual Layer Powder Coat with Treated Woven Fabric Backing; Enclosure; – 15mm PolyGlas, Grey, Heavily-Textured Industrial Grade Exterior Coating; color per District Choice. Provide Custom Color to match Exterior Finish
 - 2.56.6 Power rating 500 watts (Program) @ 8 ohms (1000W Peak)
 - 2.56.7 Coverage pattern 90° H X 60° V Coverage Pattern, Rotate Horn for proper Coverage
 - 2.56.8 Maximum 19" High x 11" Wide x 11" Deep, 24 Lbs (Without Bracket), Custom Finish

- 2.56.9 Community Model #IC6-1082/WR96 (No approved equal)
- 2.56.10 Pair of Speakers shall be connected to the Extron DMP 128 Plus in stereo, each Speaker on a separate channel (Stereo Output shall use same Input Channels as Mains)
- 2.56.11 Attach Safety Cable to Speaker on one of the M10 Rigging Points on the Speaker. Attach other end to attachment bolt on Channel Cantilever Tube Speaker Mount. Refer to drawing details for additional information.
- 2.56.12 Route Speaker Cable neatly from the Junction Box to the speaker. Leave slack for future maintenance in the J-Box. Refer to the Detail Drawings for additional requirements. Speaker Cables shall be sized for voltage drop based on run length.
- 2.56.13 Speakers shall be connected to the amplifier at 500 watts @ 8-Ohms, one speaker per channel
- 2.56.14 Refer to detail drawings Courtyard Sound System Diagram for additional information.
- 2.56.15 The speakers shall be wired with Aqua-Seal 18-AWG speaker wire to the Amplifier in the Sound Cabinet. Refer to detail drawings wiring diagram for additional information
- 2.56.16 All Exterior Hardware shall be stainless steel

Courtyard Sound System Training

- 2.57 Spares supplied to the designated representative of the Client, along with complete documentation of the materials provided. Where applicable, deliver portable equipment in the original manufacturer's supplied packaging.
- 2.58 Contractor will provide a minimum of 6 clock hours of on-site training for site staff on the Courtyard Sound System. Training for personnel shall be provided by certified technology specialists. The scope of training shall encompass system operation and procedures. Technician training should include an integrated information overview, media retrieval procedures as well as operation procedures for local control configurations. The Contractor shall provide a detailed written outline clearly describing the proposed plan for all training, for approval by the Engineer and Owner's representative.
 - 2.58.1 Training for staff will include basic system concepts. Faculty and staff will need to know how to power on/off the system, and how to access one or more media resources via remote control. Training should include use and operation of audio/video devices and techniques and troubleshooting 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.

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- 2.59 Contractor will provide a minimum of 2 clock hours of on-site training for District Technical staff on Sound Systems. Training for personnel shall be provided by certified Audio specialists. The scope of training shall encompass system operation and procedures. Technician training should include an integrated information overview, sound control procedures as well as operation procedures for all equipment in the sound rack. The Contractor shall provide a detailed written outline clearly describing the proposed plan for all training, for approval by the Engineer and Owner's representative. Contractor shall submit at training schedule to the District to coordinate which District Technical staff shall be trained.
- 2.59.1 Training for Teaching and Technical staff will include basic system concepts. Faculty and staff will need to know how to power on/off the system, control volume, access inputs, attach microphones, replace batteries, and test system for basic operations and all other operational requirements for daily use of the systems. Training should include use and operation of audio devices, techniques and troubleshooting tips. Trainers should incorporate hands-on techniques to maximize staff opportunity to incorporate into their 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.
- 2.60 Trainers shall provide Site or District Technicians with an in-depth technical overview of sound system equipment. Training should include basic overview of all equipment manuals and troubleshooting concepts. Site and District Technicians will be trained to provide setup, operation and application of sound systems. Technicians shall be instructed in the proper operation to replace all components of the sound systems. Clearly written documentation and support materials must be provided for each system. Provide support materials in a three-ring binder clearly for each system. A training manual describing operation and use of the system shall also be provided

Portable ADA Assistive Listening System

- 2.61 Contractor shall furnish (1) Portable ADA Assistive Listening Systems Kits that may be used for Conference Rooms or other small meeting spaces. The portable system is currently designated for use in Room D101 in the New Classroom Building.
- 2.61.1 Provide a self-contained portable wireless RF-Based transmitter and receivers inside a self-contained carrying case. Portable ADA Assistive Listening system shall be as manufactured by Williams Sound Corporation.
- 2.61.2 Provide self-contained FM based system Model #FM ADA Kit 37 RCH. System kit shall contain; (1) PPA T46 transmitter, (4) PPA R37 receivers, (4) HED 027 headphones, (1) MIC 090 Mini Lavalier microphone, (1) MIC 049 conference microphone, (1) CCS 029 carrying case, (1) NKL 001 neck loop receiver, (1) ADA wall plaque and (5) BAT 026-2 "AA" batteries.

- 2.61.3 The Portable ADA Assistive Listening System shall be used in Conference and Meeting Rooms. The kit must contain an battery-operated 360-degree conference boundary microphone for full coverage of the meeting room space.

Audio/Video Patch Cables

- 2.62 All patch cables must be factory manufactured. Cables may not be field modified or altered. Length of cable shall be as required by the specification section. If length is not specified, the cables shall be the nearest factory manufactured length above the minimum distance required.
- 2.62.1 Audio Cable Assemblies 25-feet in length or less; All 3.5mm stereo audio cable assemblies shall be a male to male cable fully shielded cable with 3.5mm bayonet style connectors. Extron Mini Audio Cables Series or equal. Provide minimum length of 6 feet.
- 2.62.2 HDMI Patch Cables 3-feet in length or less; All HDMI patch cables must be 4K verified and must conform to the HDMI High-Speed cable standards. Patch cable shall be Extron HDMI Micro Series High-Speed, ultra-flexible patch cables. Length of patch cable shall be either 3 feet or 1.5 feet as required for proper operation.
- 2.62.3 HDMI Patch Cables 6-feet to 15-feet in length; All HDMI patch cables must be 4K/30 verified and must conform to the Extron HDMI 4K Premium (6-12 feet) and Extron HDMI 4K High-Speed (15 feet) ultra-flexible cable standards. Patch cables shall be Extron HDMI Ultra Series patch cables. Length of patch cable shall be as required for proper operation.
- 2.62.4 HDMI Cable Assemblies for the Teacher's wallplate location - 12 feet in length; All HDMI patch cables must be 4K/30 verified and must conform to the HDMI Premium and High-Speed cable standards. Cables shall be furnished with 180o swivel head design, Vanco Pro Digital High-Speed HDMI Swivel cable, UL and CL3 rated.
- 2.62.5 Category-6 Patch Cables 25-feet or Less; Category-6 UTP patch cables shall be as manufactured by Leviton or Commscope or approved equal. Patch cables shall be provided with standard patch cable material.
- 2.62.6 All patch cables shall be provided for each type of connection required to provide a complete and operational system. All patch cables shall be factory manufactured.

Portable Systems

- 2.63 Portable Equipment shall be furnished and spares supplied to the designated representative of the Client, along with complete documentation of the materials provided. Where applicable, deliver portable equipment in the original manufacturer's supplied packaging.

- 2.64 Contractor shall furnish (1) Portable ADA Assistive Listening Systems Kits that may be used for Conference Rooms or other small meeting spaces. The portable system is currently designated for use in Room D101 in the New Classroom Building.
- 2.64.1 Provide for each Kit; A self-contained portable wireless FM transmitter and receivers inside a self-contained carrying case. Portable ADA Assistive Listening system shall be as manufactured by Williams Sound Corporation, Phone 1-800-843-3544. Provide self-contained FM based system Model #FM ADA Kit 37 RCH. System kit shall contain the following items;
- 2.64.1.1 (1) PPA T46 transmitter, (4) PPA R37 receivers, (4) HED 027 headphones, (1) MIC 090 Mini Lavalier microphone, (1) MIC 049 conference microphone, (1) CCS 029 carrying case, (1) NKL 001 neck loop receiver, (1) ADA wall plaque and (5) BAT 026-2 "AA" batteries.

Classroom AV System Training

- 2.65 **Contractor will provide a minimum of 12 clock hours of on-site training for site Technical and Administrative/Teaching Staff on the Classroom A/V systems.** Training for personnel shall be provided by certified technology specialists. The scope of training shall encompass system operation and procedures. Technician training should include an integrated information overview, media retrieval procedures as well as operation procedures for local control configurations. The Contractor shall provide a detailed written outline clearly describing the proposed plan for all training, for approval by the Engineer and Owner's representative. Contractor shall submit at training schedule to the District to coordinate which District Technical staff shall be trained.
- 2.65.1 Training for Teaching and Administrative Staff shall include basic system concepts. Faculty and staff shall be taught how to power on/off the system, control volume, access inputs, attach microphones, replace batteries, and test system for basic operations and all other operational requirements for daily use of the systems. Training shall include use and operation of audio devices, techniques and troubleshooting tips. Trainers shall incorporate hands-on techniques to maximize staff opportunity to incorporate into their 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.
- 2.65.2 Contractor shall provide on-site AV training from Extron by an Extron Trainer for the Technical Staff covering all the Extron components in the systems. All System Types - Contractor shall videotape at least (1) training session per each type of Classroom Audio-Visual System, in High Definition Video (1080p format), and save to a flash drive to turn over to the District. Training video shall be retained as property of the District.
- 2.66 Trainers shall provide Site or District Technicians with an in-depth technical overview of sound system equipment. Training should include basic overview of all equipment

manuals and troubleshooting concepts. Site and District Technicians will be trained to provide setup, operation and application of sound systems. Technicians shall be instructed in the proper operation to replace all components of the sound systems. Clearly written documentation and support materials must be provided for each system. Provide support materials in a three-ring binder clearly for each system. A training manual describing operation and use of the system shall also be provided.

PART 3 - INSTALLATION AND EXECUTION

- 3.1 Verify that all electrical requirements including junction boxes, empty conduit and power circuits and receptacles are in place as shown on the drawings.
- 3.2 Receive, check, unload, handle, store, and adequately protect equipment and materials to be installed as part of the contract. Store in areas as directed by the owner's representative. Include delivery, unloading, setting in place, fastening to walls, floors, ceilings, or other structures where required, interconnecting wiring of system components, equipment alignment and adjustment, and other related work whether or not expressly defined herein.
- 3.3 Installation practices shall follow "standard broadcast wiring" and installation practices, as excerpted from "Recommended Wiring Practices, "Sound System Engineering", (2nd Edition) D. Davis, and Performed to the highest standards of acknowledged industry practices. Upon request the A/V Contractor shall furnish all equipment and labor to verify the compliance with the following:

Optical:

- 3.3.1 Center to corner light fall off shall be less than 50% for video/data projectors.
- 3.3.2 Center to corner light fall off shall be less than 35% for optical projectors.
- 3.3.3 Images shall be level and square with the appropriate aspect ratio.
- 3.3.4 Image shall be free from visible vibration.

Audio System:

- 3.3.5 Signal-to-noise ratio (including crosstalk): 55-dB minimum.
- 3.3.6 Total harmonic distortion: 0.1% maximum from 30 Hz to 15,000 Hz.
- 3.3.7 System frequency response: ± 1.0 dB, 20 Hz to 20,000 Hz.
- 3.3.8 Program reproduction system with point-source loudspeakers: Flat response from 63 Hz to 2.5 kHz ± 2 -dB, decreasing uniformly from a relative level of 0-dB at 2.5 kHz to a relative level of -10 -dB at 10 kHz as measured on axis of loudspeaker.

- 3.3.9 Sound output capability: Program levels of not less than 100 dB without objectionable distortion, rattles, or buzzes.
- 3.3.10 Hum and noise is inaudible (below the background noise level of the space) under normal operation and as observed in normal seat locations.

Video System:

- 3.3.11 Signal-to-noise ratio (peak to RMS, unweighted DC to 4.2 MHz): 55-dB minimum.
- 3.3.12 Crosstalk (unweighted DC to 4.2 MHz): 45-dB minimum.
- 3.3.13 Frequency response: ± 0.5 dB to 4.2 Mhz.
- 3.3.14 Line and field tilt: 2% minimum.
- 3.3.15 Differential gain: 3% maximum.
- 3.3.16 Differential phase: 2° maximum.
- 3.3.17 System timing sync coincidence: within 50 nanoseconds.
- 3.3.18 Color timing: $\pm 2^\circ$ at 3.58 Mhz.

Radio Frequency (RF) System:

- 3.3.19 Visual Carrier level: +0 dBmV minimum and +16 dBmV maximum at system outlets for utilized channels.
- 3.3.20 Adjacent Channel Visual Carrier: 3-dB maximum differential at system outlets.
- 3.3.21 Non-adjacent Channel Visual Carrier: 0-dB maximum differential at system outlets.
- 3.3.22 Carrier-to-Noise Ratio: 42-dB minimum
- 3.3.23 Amplitude Response: Flat ± 1.0 Db
- 3.3.24 Signal-to-Noise Ratio: 45-dB minimum for the maximum level of the signal and the interference resulting from cross modulation from other signals on the system, after demodulation.
- 3.3.25 Outlet-to-Outlet Isolation: 25-dB minimum.

- 3.4 Adhere to manufacturer's published specifications for pulling tension, minimum bend radii, and sidewall pressure when installing cables.

- 3.5 Where manufacturer does not provide bending radius information, minimum bending radius shall be 10 times cable diameter. Arrange and mount equipment and materials in a manner acceptable to the engineer and the owner.
- 3.6 Attach cables to permanent structure with suitable attachments at intervals of 48 to 60 inches. Support cables installed above removable ceilings. Install adequate support structures for 10-foot cable service loops at each TC.
- 3.7 Provide lacing bars for cable management in all of the sound systems cabinets. Contractor shall be responsible for providing neatly dressed cable bundles within the sound cabinet. Cables shall be dressed separately for Microphone and line level cables, speaker and monitor cables, control cables and power cables and video cables. All cables shall be neatly labeled with wrap around type written labels.
 - 3.7.1 On the cable at the rear of the patch panel or termination location. Requires the use of a self-laminating wrap around label. Brady Label self-laminating 1.2" by 1.5" wrap around label Part # 29689 (NO ACCEPTABLE EQUAL).
- 3.8 All faceplates shall be labeled with type-written permanent labels securely attached to the faceplates identifying all A/V connections. (ie; Doc Cam, PC, Audio Only, etc.) Cables at the projector and A/V switch shall be also be labeled to match the faceplates.
- 3.9 Group cables according to signals being carried. To reduce signal contamination, form separate groups for the following:
 - 3.9.1 Power cables.
 - 3.9.2 Control cables.
 - 3.9.3 Video cables.
 - 3.9.4 Camera cables.
 - 3.9.5 Audio cables for signals less than minus 20 dBm.
 - 3.9.6 Audio cables for signals between minus 20 dBm and plus 30 dBm.
 - 3.9.7 Audio cables for signals above plus 30 dBm.
 - 3.9.8 Broadband RF cables.
- 3.10 Run power cables, control cables, and high level cables on the left side of an equipment rack as viewed from the back. Run other cables on the right side of an equipment rack.
- 3.11 Cut cables (except video, camera and RGBS cables, which must be cut to electrical length) to the length required by the run. All wire and cable shall be continuous and splice-free for the entire length of run. For equipment mounted in drawers or on slides, provide the interconnecting cables with a service loop of appropriate length.

- 3.12 Install no cable with a bend radius less than that recommended by the manufacturer.
- 3.13 Provide strain relief for cables. Provide connectors with metal shell/casings. Provide a minimum of three feet of free cable coiled in a floor pocket. Use spiral wrap to group similar cable types.
- 3.14 All shielded cables shall be insulated. Do not permit shields to contact conduit, raceway, boxes, panels, or equipment enclosures. Tin all terminated shield drain wires and insulate with heat-shrink tubing.
- 3.15 Land all field loudspeaker wiring entering each rack at terminal devices prior to connection to equipment or devices. Land loudspeaker level control cables at screw or tubular clamp type barrier blocks on the left side of the equipment rack as viewed from the rear. Make all connections to screw-type barrier blocks with insulated crimp-on spade lugs. Size all lugs properly to assure low-resistance connections.
- 3.16 Separately dress, route and land microphone and line level cables directly to equipment.
- 3.17 Use only rosin core 60/40 tin/lead solder for all solder connections.
- 3.18 Lace, tie or harness wire or cable in accordance with accepted professional practice. Dress, lace or harness all wire and cable to prevent mechanical stress on electrical connections; no wire or cable shall be supported by a connection point. Provide service loops where harness of different classes cross or where hinged panels are to be interconnected.
- 3.19 Patch Panel Assignments: Wire patch panels so that signal “sources” (outputs from) appear on the upper row or a row pair and “loads” (input to) appear on the lower row of a row pair.
- 3.20 Patch Panel Designation Strips: Use alphanumeric identifications and descriptive information on patch panel designation strips. Number the jack positions in each horizontal row sequentially from left to right. Letter the horizontal jack rows sequentially from top to bottom. Include the alphanumeric identification of each jack on the functional block drawings, and on reproductions of these drawings that shall be mounted in an appropriate location near the patch bays.
- 3.21 Each major component of equipment shall have the manufacturer's name, address, model number, and rating on a plate securely affixed in a conspicuous place. NEMA code ratings, UL label, or other data which is die-stamped into the surface of the equipment shall be stamped in a location easily visible.
- 3.22 Upon completion of the work, remove all refuse and rubbish from and about the premises, and leave the relevant areas and equipment clean and in an operational state.
- 3.23 During the installation, and up to the date of final acceptance, protect finished and unfinished work against damage and loss. In the event of such damage or loss, replace or repair such work at no cost to the owner.

- 3.24 Prior to final acceptance, provide minimum of three complete sets of drawings showing all cable numbers and construction details in accordance with the actual system installation. Revise the device layout drawings to represent actual installation locations and coordinate these with the electrical Contractor. The operation manual shall contain all instructions necessary for the proper operation of the installed system and manufacturer's instructions. The maintenance manual shall contain all information required for the "proof of performance" as required and all manufacturers' maintenance information.

Inspection and Test upon Completion

- 3.25 Check out and final connections to the system shall be made by the Contractor of the products installed. Technicians shall demonstrate operation of the complete system and each major component to the Owner.
- 3.26 System field wiring diagrams shall be provided to the owner by the system Installer (Contractor) prior to completion of the installation.
- 3.27 All materials and installation shall be guaranteed to be free of defects in material and workmanship for two years after final acceptance of installation and test.
- 3.28 Upon completion of the installation, four (4) copies of complete operational instructions shall be furnished, complete with record drawings. Instructions shall include part numbers and names, addresses, and telephone numbers of parts source. Final payment shall not be made until operational and maintenance manuals have been received.
- 3.29 The Contractor shall be responsible to provide service within 24 hours (or by mutual consent) after notification by the Owner or his representative, within the hours of 8:00 AM to 5:00 PM from Monday through Friday. Service request forms shall be supplied by the Contractor and the faxing or mailing of such a request form shall constitute notification by the Owner of a service request.
- 3.30 The Contractor shall provide two "preventative maintenance" service calls, spaced six months apart, for cleaning of all source devices and overall inspection of the system.

PROJECT CLOSEOUT

- 3.31 Prior to completion of project, compile a complete equipment maintenance manual for all equipment supplied under sections of this division, in accordance with these specifications and as described below.
- 3.32 Equipment Lists and Maintenance Manuals:
- 3.32.1 Prior to completion of job, Contractor shall compile a complete equipment list and maintenance manuals. The equipment list shall include the following items for every piece of material equipment supplied under this section of the specifications:
- 3.32.1.1 Name, model, and manufacturer.

- 3.32.1.2 Complete parts drawings and lists.
 - 3.32.1.3 Local supply for parts and replacement and telephone number.
 - 3.32.1.4 All tags, inspection slips, instruction packages, etc., removed from equipment as shipped from the factory, properly identified as to the piece of equipment it was taken from.
- 3.33 Maintenance manuals shall be furnished for each applicable section of the specifications and shall be suitably bound with hard covers and shall include all available manufacturers' operating and maintenance instructions, together with "as-built" drawings to properly operate and maintain the equipment. The equipment lists and maintenance manuals shall be submitted in duplicate to the Architect for approval not less than 10 days prior to the completion of the job. The maintenance manuals shall also include the name, address, and phone numbers of all subContractors involved in any of the work specified herein. Four copies of the maintenance manuals bound in single volumes shall be provided.

RECORD DRAWINGS

- 3.34 The Contractor shall maintain record drawings as specified in accordance with these specifications, and as noted below.
- 3.35 Drawings shall show locations of all concealed and exposed conduit runs, giving the number and size of conduit wires. Underground ducts shall be shown with cross section elevations and shall be dimensioned in relation to permanent structures to indicate their exact location. Drawing changes shall not be identified only with referencing CORs and RFIs, the drawings shall reflect all the actual changes made.
- 3.36 Final As-Built Drawing Submittals - Provide (1) hard bound copy of "E-size" As-Built drawings and (3) copies on USB Flash Drive in AutoCAD (2014 or newer version) format. A Hand marked-up copy of the original construction drawings will not be accepted as the final As-Built drawing submittal. Final As-Built drawings shall include copies of the floor plan drawings of each building, detailed As-built AV Diagrams including wire and connection type, elevations of all AV Cabinets, quantities of mic outlets and speaker locations, locations of all final cable routes, including conduits. In addition, the drawings shall include all outlet locations with cable identification label information.

END OF SECTION 272000

SECTION 275116 – WIRELESS CLOCK SYSTEM

PART 1 – GENERAL

- 1.1 The Contractor shall provide an additional Wireless Clock Transmitter to the existing Wireless Clock System as shown on the drawings and as described in these specifications including all connectors, power supplies, and auxiliary equipment as may be required and as specified herein.

- 1.2 Related Specification Sections:

1.2.1 Section 26 01 00 - General Provisions

- 1.3 **Existing Wireless Clock System is Primex Wireless**

Equipment manufactured by Sprint, TOA, Telecor, Practek, Precise, QIS or any other manufacturer not listed above have been reviewed and are not considered equal or approved for use on this project.

Quality Assurance

- 1.4 All items of equipment including wire and cable shall be designed by the manufacturer to function as a complete system and shall be accompanied by the manufacturer's complete service notes and drawings detailing all interconnections. The distributor must also provide complete installation of all wiring and devices or equipment.
- 1.5 The contractor shall be an established communications and electronics contractor that has had and currently maintains a locally run and operated business for at least five years. The contractor shall utilize a duly authorized distributor of the equipment supplied for this project location with full manufacturer's warranty privileges.
- 1.6 The contractor shall guarantee availability of local service by factory- trained personnel of all specified equipment from an authorized distributor of all equipment specified under this section. On-the-premise maintenance shall be provided at no cost to the purchaser for a period of one (1) year from date of installation unless damage or failure is caused by misuse, abuse, neglect, or accident.
- 1.7 Deliver products in factory containers. Store in clean, dry space in original containers. Protect products from fumes and construction traffic. Handle carefully to avoid damage.

Submittals

- 1.8 Phase I Submittal shall be made **within (20) working days** after the award of the contract by the District. This submittal shall include the following:
- 1.8.1 Complete bills of quantities, including all materials, components, devices, and equipment required for this work. The bills of quantities shall be tabulated respective of each and every system as specified, and shall contain the following information for each item listed:

- 1.8.1.1 Quantity of each type of equipment item.
- 1.8.1.2 Description of each item.
- 1.8.1.3 Manufacturer's Name and Model Number.
- 1.8.1.4 Manufacturer's Specification Sheet.
- 1.8.1.5 Equipment items which have individual components, will require that all component parts be listed individually.
- 1.8.1.6 Description of any specialty backbox requirements.
- 1.8.1.7 All wiring types required for installation of this system.

1.9 **Common submittal mistakes which will result in the submittals being rejected:**

- 1.9.1 Not including the qualifications of the installing contractor.
- 1.9.2 Not including all items listed in the above itemized description.
- 1.9.3 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
- 1.9.4 Not including actual manufacturer's catalog information for proposed products.
- 1.9.5 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

PART 2 – PRODUCTS

Wireless Clock System

- 2.1 Acceptable clock manufacturer shall be by Primex Wireless, N3211 County Road H, Lake Geneva WI 53147 (800) 537-0464 FAX (262) 248-0061 EMAIL www.primexwireless.com **(no approved equal)**.
- 2.2 Provide a complete synchronized wireless master - satellite time system - Primex Wireless Command Point transmitter.
- 2.3 Clock system shall continually synchronize clocks throughout the facility and shall be capable of clock readouts in multiple time zones where desired.
- 2.4 Time system shall be a synchronized master-satellite time system. The system shall synchronize all clocks to each other. The system shall utilize GPS technology to provide atomic time. The system shall not require hard wiring. Clocks shall automatically adjust for Daylight Savings Time.
- 2.5 Clocks shall be synchronized to within 10 milliseconds 6 times per day, and the system shall have an internal oscillator that maintains plus or minus one second per day between synchronizations, so that clock accuracy shall not exceed plus or minus 0.2 seconds.

- 2.6 The system shall include internal clock so that failure of the GPS signal shall not cause the clocks to fail in indicating time.
- 2.7 The system shall incorporate fail-safe design so that failure of any component shall not cause failure of the system. Upon restoration of power or repair of failed component, the system shall resume normal operation without the need to reset the system or any component thereof.

Regulatory Requirements

- 2.8 The end user will hold a license, known as a “Radio Station Authorization” granted by the FCC. This license grants the end user protected use for wireless transmission at the designated frequency.
- 2.9 The system must operate in accordance with a “Radio Station Authorization”, Form FCC 601 – LM, granted by the Federal Communications Commission (FCC). This license will be issued to and held by the end user.
- 2.10 FCC 1068 – A “Telecommunications Bureau Supplemental Information” must be completed and signed by end user prior to license issuance.
- 2.11 This license will designate a unique “call sign” for each end user.
- 2.12 Transmitter and receiver shall comply with Part 90 of FCC rules as follows:
 - 2.12.1 This device may not cause harmful interference and this device must accept interference received, including interference that may cause undesired operation.
 - 2.12.2 System shall be installed in compliance with local and state authorities having jurisdiction.
- 2.13 Transmitter frequency shall be governed by FCC Part 90.35.
- 2.14 Transmitter output power shall be governed by FCC Part 90.257 (b).
- 2.15 Permits: Obtain operating license for the transmitter from the FCC.

Project Site Conditions

- 2.16 Coordinate installation of Ground Plane Antenna with work on the roof so that the brackets and related fasteners are watertight. Antenna cable connections must be sealed with a flexible watertight sealant, such as silicone.

Sequence of Operation

- 2.17 Transmitter: When power is first applied to the transmitter, it checks for and displays the software version, then it checks the position of the switches and stores their position in

memory. The transmitter shall synchronize with the Main Transmitter in the existing MDF Room for the correct time.

Equipment

- 2.18 General: The time system shall include a transmitter, roof mounted antenna, indicating clocks and all accessories for complete operation.
- 2.19 Transmitter: Secondary Transmitter Located in IDF Closet; Primex Wireless Model #XR01EM, consisting of a 1-watt wireless transmitter with an external Ground Plane Omnidirectional Antenna mounted on the roof. Transmitter shall be synchronized with the existing Main Transmitter in the MDF Room. Unit shall obtain current atomic time from the existing Main Transmitter. The clock system shall transmit time continuously to all clocks in the system. Do not provide a repeater for this location.

Transmission

- 2.20 Frequency Range: (Five watts and One watt) at frequency of 72.100 to 72.400 MHz.
- 2.21 Radio technology: Narrow band FM
- 2.22 Number of channels: 16
- 2.23 Channel bandwidth: 20 kHz maximum
- 2.24 Transition mode: One-way communication
- 2.25 Data rate: 2 Kbps
- 2.26 Operation range: 0 degrees C. to 70 degrees C.

Transmitter

- 2.27 Transmitter output power: +30 dBm (five watts)
- 2.28 Frequency deviation: +/-4 kHz
- 2.29 Transmitter power requirements: 120 VAC 60 Hz
- 2.30 Internal power requirements: 3.3 volts DC
- 2.31 Carrier frequency stability: +/- 5 ppm
- 2.32 Transmitter shall have 16 selectable channels to assure interference-free reception.
- 2.33 Transmitter shall have the following switches:
 - 2.33.1 Time zone adjust switches for all time zones in the world. Includes all US time zones: Eastern, Central, Mountain, Pacific, Alaska and Hawaii.

- 2.33.2 Daylight Saving Time bypass switch.
- 2.33.3 12-hour or 24-hour display.
- 2.34 Transmitter housing shall incorporate a display which shall include the following:
 - 2.34.1 Time readout
 - 2.34.2 AM and PM indicator if 12-hour time display is set
 - 2.34.3 Day and date readout
 - 2.34.4 Indicator for Daylight Savings or Standard Time
 - 2.34.5 LED which shall flash red in event of reception problem

Transmitter Antenna

- 2.35 Provide an external Ground Plane Antenna for the Wireless Clock Transmitter located in the IDF Closet. Ground Plane Antenna shall be Primex Wireless Model “Outdoor Ground Plane Antenna” (or approved equal) with 100-feet of included coaxial antenna cable. The Contractor shall trim the antenna cable length to remove excess. Provide a 5-foot service loop attached to the backboard below the transmitter shelf, prior to connecting cable to transmitter. Refer to the floor plans for the location of the transmitter shelf in the IDF Closet. The antenna shall be mounted on the rigid conduit provided by the Division 26 Contractor stubbed 3-feet above the roof line. Coordinate the location of the conduit with the Division 26 Contractor. Route the Coaxial Antenna cable from the Transmitter location to the roof.
- 2.36 Antenna shall be mounted to the 1-1/4” Rigid conduit provided by the Division 26 Contractor, on the roof of the building. Antenna shall be mounted a minimum of 36" above the roof. Provide pole mount for antenna to adapt to the 1-1/4” conduit. Distance shall not exceed 100 feet from the Transmitter to the Antenna location overall.
- 2.37 Conduit shall be furnished with a single exit weatherhead. Contractor shall seal weatherhead with the silicone sealant.
- 2.38 Installer to select appropriate cable length for distance between the Ground Plane Antenna and Transmitter from the following:
 - 2.38.1 Provide coaxial cable for roof mounted antenna. Extend the cable to the antenna location from the Transmitter. Ground Plane Antenna is provided with 100-feet of coaxial cable. Cable shall be trimmed to remove excess cable and re-terminated by the Contractor. Test cable for proper loss parameters. Match the existing cable terminations from the manufacturer. Do not leave more than a 5-foot service loop in the IDF Closet.

- 2.38.2 Cables shall be neatly dressed at the antenna location and provided with a minimum 12" drip loop to prevent water ingress into the conduit and to the IDF Closet.
- 2.39 Cable Connection Sealant; Provide approved electrical grade non-hardening silicone sealant for cables exiting the weatherhead. Contractor shall be responsible for sealing the weatherhead after the cables have been installed. Sealant shall be rated for outdoor full exposure and have a minimum 20-year life rating. Provide by GE Silicone 2*+ Roof Sealant (or approved equal).

Wireless Clocks

- 2.40 **Wireless Clocks shall be furnished and installed by the District in the New Classroom Building.**

Transmitter:

- 2.41 Locate transmitter at the height indicated in the drawing details, on a fixed shelf on the plywood backboard in the IDF Closet. Provide a single-sided shelf, black color, for the wireless transmitter mounted to the wall by CPI Model #40074-700 (or approved equal). Provide (2) adjustable rack shelf straps to hold the transmitter in place and secure it to the shelf. Strap must be routed behind shelf prior to securing the shelf to the backboard. Straps shall be constructed of a nylon material a minimum of 1" wide. Provide Rack Shelf Straps as manufactured by Rack Solutions Part #1USHL-STRAP (or approved equal).
- 2.42 Connect to external antenna assembly mounted on the roof of the building.
- 2.43 Connect power supply to the transmitter.
- 2.44 Set the channel number on the display to correspond to the FCC license.
- 2.45 Plug power supply into electrical outlet.

PART 3 - EXECUTION

Inspection and Test upon Completion

- 3.1 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 Owner.
- 3.2 All materials and installation shall be guaranteed to be free of defects in material and workmanship for two years after final acceptance of installation and test.

END OF SECTION 275116

SECTION 280100 - ELECTRONIC SAFETY AND SECURITY GENERAL PROVISIONS

ARTICLE 1 - SUMMARY

- 1.1 This Division of the specifications outlines the provisions of the contract work to be performed as a subcontract under the Division 26 scope of work. Reference the Division 26 Electrical General Provisions for scope of work and general requirements.
- 1.2 In addition, work in this Division is governed by the provisions of the bidding requirements, contract forms, general conditions and all sections under Division 1 requirements.

END OF SECTION 280100

SECTION 281300 - SECURITY SYSTEM

PART 1 – GENERAL

- 1.1 Furnish all materials, equipment and labor, and perform all operations in connection with systems work as indicated on the drawing, as specified herein and required to complete the work.
- 1.2 Related Specification Sections:
 - 1.2.1 Division 26 05 33 – Conduit and Fittings
 - 1.2.2 Division 26 05 19 or 26 05 13 – Conductors
 - 1.2.3 Division 26 05 34 – Outlet and Junction Boxes
- 1.3 All security system components shall be manufactured by and wiring shall be furnished and installed by a factory authorized contractor and distributor. The Contractor shall hold a license from the State of California for the purpose of installing security systems.
- 1.4 The contractor shall be regularly engaged in the installation and repair of the type of equipment to be installed.
- 1.5 The conduit, outlets, terminal cabinets, device backboxes, etc., which form a part of the rough-in work, shall be furnished and installed complete by the Contractor. Security system components as listed under products shall be furnished and installed by the authorized subcontractor.
- 1.6 The subcontractor shall furnish all equipment, accessories and material required for the complete installation of a security system in accordance with specifications and as shown on the drawings. Any material and/or equipment necessary for the proper operation of the system not specified or described herein shall be deemed part of this specification. The distributor must also provide complete installation of all wiring and devices or equipment. Supervised installation for the wiring and devices shall be permitted with the following conditions:
 - 1.6.1 A letter will be required from the security system manufacturer's representative certifying that the cable installation was completed in compliance with the manufacturer's recommended installation requirements.
 - 1.6.2 The cables shall be tested in the presence of the manufacturer's representative. These tests will then be submitted to the electrical engineer.
 - 1.6.3 The security system shall be warranted by the manufacturer's representative per the contract agreement.
- 1.7 **Phase I Submittal shall be made within (20) working days after the award of the contract by the District.** This submittal shall include the following:

- 1.7.1 Complete bills of quantities, including all materials, components, devices, and equipment required for this work. The bills of quantities shall be tabulated respective of each and every system as specified, and shall contain the following information for each item listed:
 - 1.7.1.1 Description and quantity of each item.
 - 1.7.1.2 Manufacturer's Name and Model Number.
 - 1.7.1.3 Manufacturer's Specification Sheet.
 - 1.7.1.4 Description of any specialty backbox requirements.
- 1.8 **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 disc copy with files in a AutoCAD 2000i or 2004 format. Building floor plan CAD files on disc will be made available via express mail after the receipt of payment of \$50.00 per building floor plan, or \$300.00 minimum which ever is lesser. Contractor shall make the request for drawings in writing directly to Johnson Consulting Engineers, confirmation of the request and a release form will be forwarded to the contractor to include a signed copy with payment prior to release of files. Detail or riser diagram sheets or any other drawings other than floor or site plans, will not be made available to the contractor. Phase II submittals drawings shall include the following.
 - 1.8.1 Provide complete shop drawings to include:
 - 1.8.1.1 Complete floor plans showing the locations throughout the project of all receptacles, conduits, wireways, tray, pullboxes, junction boxes, equipment locations, and other devices.
 - 1.8.1.2 Typical system riser diagrams, specialty equipment or rack elevations will be required to be provided.
- 1.9 The contractor shall provide as part of this contract additional ceiling motion sensors, wall motion sensors, glass-break sensors, security door and roof hatch contacts to equal 10% of the total quantity of devices shown on the drawings or a minimum of three (3) for each type, whichever is greater. Installation of conduit, boxes and wiring of these devices shall be included, and required locations coordinated with final approved shop drawings. Any deices not required to be included during construction shall be delivered to the District at the completion of the project. The quantities of these devices shall be listed as a part of the Phase 1 submittals.
- 1.10 Common submittal mistakes which will result in submittals being rejected:
 - 1.10.1 Not including the qualifications of the installing contractor.
 - 1.10.2 Not including all items listed in the above itemized description.

- 1.10.3 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting underlining or clouding the items to be reviewed, r crossing out the items which are not applicable.
- 1.10.4 Not including actual manufacturer's catalog information of proposed products.
- 1.10.5 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "To be determined later" statements. The products being submitted must be the products installed.

PART 2 – PRODUCTS

Building Security System – Control Panel

- 2.1 Control Panel in the location shown in the specifications and the drawing details. The existing Security System on the campus is as manufactured by **Digital Monitoring Products (DMP)**. The new security panel in the New Classroom Building shall match the existing campus system.
- 2.2 The Control/Communicator panel shall be a multiplex micro processed based system as manufactured by **DMP Model XR550N**. Provide Control Panel in IDF Closet in the New Classroom Building. Control Panel shall be set up to act as an expansion panel for the existing security system with the existing Main Control Panel in the Administration Building serving as the Master Control Panel. Refer to the floor plans for the location of the panel.
- 2.3 The system must be able to provide the following minimum functions:
 - 2.3.1 Provide capacity for 574 individual zones.
 - 2.3.2 Up to 16 independent Access Control Door locations (Wiegand).
 - 2.3.3 Minimum capacity of (16) Supervised keypads from one control panel.
 - 2.3.4 Up to 500 wired or wireless LX Bus devices
 - 2.3.5 Fully supervised 10/100 Ethernet network and CDMA/HSPA+ cellular communications capabilities.
 - 2.3.6 Central Station reporting via ethernet connection (IP) and simultaneous digital dialer for multiple central station receivers.
 - 2.3.7 Interface with the district central monitoring system to report all addressable devices individually (by site, building and room) and to be remotely programmable from the district central system for maintenance and changes to the system.
 - 2.3.8 U.L. listed for Burglary and access control

- 2.3.9 Battery backup included
- 2.3.10 Capability to extend keypad or sensor wiring bus lengths to a minimum of 15,000 ft.
- 2.3.11 Systems or components as manufactured by Bosch, Honeywell, Radionics or any other manufacturer's which are not specifically listed in 2.1, are not approved for use on this project
- 2.4 Provide a complete and operable supervised intrusion detection system including, but not limited to; control panel, keypad stations, motion detectors, door contacts, zone expanders and repeaters and a digital communicator.
 - 2.4.1 The new Control Panel shall be tied in with the existing Main Control Panel in the MDF Room in the Administration Building
 - 2.4.2 Upon detection of an intruder by initiation of any device in the system, the system shall cause alarm information to be sent by (IP) to the district central station and by digital dialer to an independent alarm monitoring agency. Each motion sensor and or door contact shall have a distinct address and each address shall report to the monitoring agency including the site name, building name, and room number identifications associated with each device. The installing contractor must submit a list of all devices and their reporting identifications to the district for review and approval prior to any programming. Naming and room numbers must be consistent with actual facility identifications, which may vary from identifications included in the bid construction documents. An operational test of each installed system must be able to confirm compliance with the above requirements for each device installed, before the system will be considered complete and operational.
 - 2.4.3 Coordinate with the District Facilities Department for integration with the existing campus security system for access to the Administrative Level software for system programming.
 - 2.4.4 Upon detection of an intruder by any initiation device in the system, the system shall cause a prerecorded message to be played over the campus intercom system. The intercom system shall play the message over all INTERIOR only speakers. The message shall repeat (2) times "An unauthorized entry to the facility has been detected, authorities have been contacted "in both English and Spanish.
- 2.5 Systems shall detect the entry and/or the motion of a body taking not more than four steps in an area secured with motion detection equipment where entry doors or windows are possible access.
- 2.6 New Classroom Building shall be zoned and controlled separately and each sensor individually addressable so that portions of the facility may be secured while others remain unsecured. All zones for the New Classroom Building shall be able to be armed or disarmed from a new keypad added next to the existing Master Keypad location in the

Administration Building. Add (1) keypad next to the existing Master Keypad in the Administration Building. Provide cabling from the Control Panel in the New Classroom Building to the new keypad location.

2.6.1 Existing Master Keypad in Administration Building

2.6.1.1 Provide programming changes to the existing Master Keypad and existing Main Security Panel in the Administration Building as required to add control for the New Classroom Building's zones for the Global Campus arm/disarm functions. The New Classroom Building shall be armed/disarmed with the rest of the existing campus zones. Set pass codes and user access for the additional Teachers and Staff that will be using the New Classroom Building. This would disarm the building and the "Disarmed Indicator Light" at the existing annunciator will be triggered. Add the new classroom building to the existing Annunciator.

2.6.2 New Classroom Building Standard Keypad

2.6.2.1 A new keypad will be provided for the New Classroom Building in the existing Administration Building. Coordinate the final location of the keypad with the District Facilities Department. Control will be provided from this Keypad for arming or disarming the zones in the New Classroom Building.

2.6.2.2 When staff arrives, they would present their code to the keypad. This would disarm the building in which the staff works, and the not armed indicator light at the annunciator will be triggered.

2.6.2.3 When staff is leaving, (and presumably is the last one from their building leaving) they would press the "Command" button, then select "Arm", then select "All". The building would arm, and the armed indicator light at the annunciator will be triggered

Building Security System – System Devices

2.7 Provide the Security System Devices as shown on the project floor plans. Every type of device described below may or may not be shown on the floor plans. Devices shall be provided to match the existing Campus Security System.

2.8 Keypads - Keypads shall be alpha numeric LCD display series capable of displaying system status and controlling the alarm system. Unit shall receive its operating power from the control panel.

2.8.1 Provide keypads at locations where on drawings for coverage of the zones as required by District. Each building or zone shall be furnished with a keypad, unless otherwise noted on the drawings or in these specifications. All zones shall have the ability to be controlled by the existing Master Keypad located in the Administration Building. Provide two-line Alphanumeric 32-character LCD

display keypad with two-button panic and four zones by DMP Model # 7073A Aqualite Series Keypads (No Approved Equal).

- 2.9 Motion Sensors - Motion sensors shall be passive infrared with microwave Doppler radar detection. Sensor coverage patterns shall be as required for optimum coverage at each individual location. Sensor shall be wall mounted at the locations as shown on the drawings.
 - 2.9.1 Wall Mounted Motion Sensors – Classrooms – DMP Model #Optex DX-60 Plus (No Approved Equal). Dual Tech PIR and Microwave wall mounted sensor with a minimum coverage pattern capability of 60-feet by 60-feet. Larger non-classroom spaces shall also be provided with this model of sensor.
 - 2.9.2 Wall Mounted Motion Sensors – Offices, Workrooms or other similar smaller rooms - DMP Model #Optex DX-40 Plus (No Approved Equal). Dual Tech PIR and Microwave wall mounted sensor with a minimum coverage pattern capability of 40-feet by 40-feet.
 - 2.9.3 Contractor shall furnish and install the wall mount brackets for the wall mounted motion sensors by DMP Optex Model #FA-1W or Model #FA-3 (No Approved Equal). Type of bracket provided shall be based on desired coverage for the sensor.
 - 2.9.4 Ceiling Mounted Motion Sensors in Rooms with Accessible Ceilings – DMP Model #Optex FX-360 (No Approved Equal). Rooms with accessible ceiling, between 8-12 feet in height, shown with ceiling mounted sensors shown on the floor plans, shall be furnished with a PIR Technology ceiling mounted sensor with a minimum coverage pattern capability of 25-feet to 40-feet in diameter.
- 2.10 Door Contacts – Door contacts shall be provided at all exterior doors and at all roof hatches. Contractor shall refer to the drawings for the locations of the doors and roof hatches. In addition, all roll-up type garage doors or security shutters shall be provided with door contacts.
 - 2.10.1 Door contacts for standard doors at drywall walls or accessible walls shall be installed as recessed contacts. Provide DMP Model #1076C Magnetic Terminal Contacts (No Approved Equal).
 - 2.10.2 Door contacts for standard doors at concrete or CMU walls or non-accessible walls shall be installed as surface mounted contacts. Provide DMP Model #Sentrol 1085TW Magnetic Wide Gap Terminal Contacts (No Approved Equal).
 - 2.10.3 Door contacts for Store Front glass doors shall be installed as miniature size recessed contacts. Provide DMP Model #STB-10 Magnetic Terminal Contacts (No Approved Equal).
 - 2.10.4 Door contacts for overhead roll-up garage doors or security shutters shall be surface mounted heavy-duty, industrial wide gap type with 36” armored cable by DMP Model #Sentrol 2505A Magnetic Terminal Contacts (No Approved Equal).

- 2.10.5 Door contacts must be installed using the screws and the adhesive contact sheet provided with the door contact or with the screws alone. Installation using the adhesive contact sheet alone is not allowed.
- 2.10.6 Cable splice connections for the armored cable provided with overhead roll-up garage door contacts shall be provided inside a dual gang junction box in an accessible location for future maintenance. The junction box shall be provided with a blank cover labeled with a permanent type-written label showing the unique device number and any zone information or door number.

Building Security System – System Cable

- 2.11 Wire and Cable - Cabling shall be as required for system operation or as shown in the specifications and detail drawings. Refer to the floor plans for additional requirements.
 - 2.11.1 Interior Riser Rated Keypad Cable - Provide (4) conductor, 18-AWG, Polypropylene coated stranded bare copper conductors with PVC jacketed, Riser-rated cable for keypad locations within a building. Provide Honeywell Part #2115 or West Penn Part #244.
 - 2.11.2 Exterior Riser Rated Keypad Cable - Provide (4) conductor, 18-AWG, stranded bare copper conductors with PVC jacketed, Outdoor-rated, direct burial type cable for keypad locations between buildings. Cable shall be used for all exterior cable runs. Provide Honeywell Part #4157 or West Penn Part #AQ244.
 - 2.11.3 Interior Riser Rated Motion Detector Cable - Provide (4) conductor, 22-AWG, Polypropylene coated stranded bare copper conductors with PVC jacketed, Riser-rated cable for motion detector locations within a building. Provide Honeywell Part #2104 or West Penn Part #241.
 - 2.11.4 Interior Riser Rated Door Contact Cable - Provide (2) conductor, 22-AWG, Polypropylene coated stranded bare copper conductors with PVC jacketed, Riser-rated cable for door contact locations within a building. Provide Honeywell Part #2102 or West Penn Part #221.
 - 2.11.5 All cables shall be permanently labeled with a permanent type-written label showing a unique cable number a minimum of two locations, one within 6" and one 24" from the point of termination at the end of the cable.
- 2.12 Provide other items as shown in the drawings or specifications.

PART 3 – EXECUTION

- 3.1 All connections throughout the system shall be soldered, crimped by means of AMP lugs, fastened with screw type terminals, made by spring tension clip "punch block" terminals or made by standard plugs and receptacles. All conductors in terminal cabinets shall be neatly routed and dressed with Velcro style cable ties in a workmanlike manner. The cable ties shall not cover any labeling at the ends of the cables.

- 3.2 All security system cabling shall be installed in conduit where indicated on the drawings or where routed exposed and shall be open wiring where routed above accessible ceilings or in walls.
- 3.3 Locate motion sensors on walls to provide optimum coverage of the space and to not conflict with the architectural aesthetics of the building. Locations of motion sensors as shown on the electrical plans are diagrammatic only.
- 3.4 Keypads shall be wired not to exceed 1000 ft cable run from the main control panel and no more than two (2) keypads per 1000-foot cable run. Provide #18AWG minimum. **All Cables routed underground shall be suitable for wet location provided with UL listed wet location insulation or flooded type cable construction.**
- 3.5 All wet location cables routed through handholes or manholes shall be provided with a service loop inside the handhole or manhole. The cable shall be provided with a minimum of one entire loop around the inside of the perimeter of the handhole.
- 3.6 Pull strings shall be provided with all cable runs including but not limited to; conduit stub ups, conduit sleeves, cable trays, open wiring routes and point-to-point conduits. Pull strings shall be free from cable bundles in open wiring routes. Pull strings shall not be substituted for pull ropes for the exterior site conduits.
- 3.7 Velcro cable management straps are required on all Security System cable bundles the last 20 feet or upon entry into equipment closet a maximum of 12" apart. Cable bundles shall also be routed through cable management or "D" rings in the equipment closet to the Security System backboard location shown on the floor plans.
- 3.8 The 28 13 00 Contractor shall supply protective bushings or slide on rings at the ends of all exposed conduits used for the security system cabling. This is to include all conduits installed for any future data cabling requirements. Contractor shall submit planned protection bushings prior to installation of cabling for approval.
- 3.9 Where open wiring cables are run through the ceiling space the wire shall be bundled together and supported above the ceiling.
- 3.10 The 28 13 00 Contractor may not use the cable suspension system installed by the 27 10 00 Contractor (for data cabling) for the security cabling. The 28 13 00 Contractor shall furnish and install a separate suspension system for the security system cabling.
 - 3.10.1 All cables must be fastened to the building structure via "j-hooks" or an approved suspension system, and not directly in contact with ceiling system. For "j-hooks" follow the maximum fill capacity as recommended by the manufacturer based on the outside diameter of the security cables. For large quantities of cables, use a sling support system such as "Erico Cable Cat" or equal. D-rings, "Caddy #WMX cable hangar", "Caddy Bridle Rings", drive rings or any other type of wire ring support is not allowed.
- 3.11 Where cables pass through a fire-resistant portion of the structure, conduit sleeves shall be provided to maintain the rating of the wall penetrated. Sealing of all penetrations with

an approved fire barrier is required. Conduits and sleeves must remain accessible for future use. Permanent sealants may not be used to seal sleeves and conduits.

- 3.11.1 The 28 13 00 Contractor shall coordinate with the 27 10 00 Contractor, 27 20 00 Contractor, 28 23 00 Contractor and any other Low Voltage Contractor working on the project, for use of the sleeve penetrations shown on the drawings.
- 3.11.2 The 28 13 00 Contractor shall be responsible for replacing the fire-stopping materials on any sleeve penetration used that was previously sealed. The firestopping material used for the replacement must match the existing materials.
- 3.11.3 If there are no existing conduit sleeves through the rated walls that must be penetrated, the 28 13 00 Contractor shall be responsible for providing the conduit sleeve and the fire-stopping materials as shown in the drawing details.
- 3.11.4 Expanding foam is not an acceptable sealant for any conduit opening. Contractor shall be responsible for complete replacement of the conduit and cabling in any conduit filled with expanding foam used as a sealant.
- 3.12 The minimum bending radius for all cables and the maximum pulling tension shall not exceed manufacturer's recommendations.
- 3.13 Provide a full 360-degree loop of slack cable around pullbox interiors. Cables entering pullboxes from the bottom, shall not be allowed to touch the bottom of the cover when closed and shall not be pinched or crushed in any way.
- 3.14 When pulled through conduits, cable pulling lubricants shall be continuously applied to all cables and be specifically approved by the manufacturer.
- 3.15 Where cables are pulled through or pulled from a center of run, pull without splices or terminations, lead out the cables at all manholes, pullboxes, and conduits, taking care to feed them in again by hand for the next run.
- 3.16 A pull string shall be placed with all security device cables at the time of installation. Conduit runs and surface raceway for station cabling shall be furnished with a minimum 2-Ply spiral wrap style, pull string rated for 240 ft/lbs. pulling strength, such as manufactured by Greenlee #431 or approved equal. Includes all conduit stubs and cables routed through open ceilings and cable trays. Pull strings shall be tied off in the junction box and in the ceiling. Provision for the installation of the pull string shall apply to all empty and spare conduits as well. Single ply type pull string will not be accepted as a substitute for the 2-ply pull string.
- 3.17 A measuring pull tape shall be placed with all OSP-Rated Site Security cables at the time of installation. Outdoor conduit runs between buildings designated for feed cabling, in excess of 150 feet shall be provided with a minimum ½" polyaramid style, measuring true tape pull string annotated with footage increments rated for 2500 ft/lbs. pulling strength, such as manufactured by Greenlee #39245 or approved equal. Conduit runs less than 150 feet shall be furnished with a ¼" polyaramid style, measuring true tape pull string annotated with footage increments rated for 1250 ft/lbs. pulling strength, such as

manufactured by Greenlee #39243 or approved equal. Provision for the installation of the measuring pull tape shall apply to all empty and spare conduits as well. Standard twine style pull strings and standard nylon or polypropylene style pull ropes will not be accepted as a substitute for the polyaramid measuring tape type pull string.

- 3.18 All cables shall be new and extend continuous from each MDF Closet Security backboard or IDF Closet Security backboard to all outlet locations.
- 3.19 Where cables are not installed in a conduit or other raceway system, they shall not be routed parallel with other line voltage equipment or wiring (120 volt and above) within 36" or within 12" of line voltage equipment or wiring where crossing.
- 3.20 Labeling
 - 3.20.1 Each cable run shall be permanently labeled at each end with a unique sequential number which corresponds to a similar number provided for each security device. A printed label shall be placed at each of the following locations;
 - 3.20.1.1 On the cable at the point of termination or termination block. Requires the use of a self-laminating wrap around label. Brady Label self-laminating 1.2" by 1.5" wrap around label Part #29689 (NO ACCEPTABLE EQUAL).
 - 3.20.1.2 On each cable in the j-box behind the device location or on the cable before the point of termination at the device, for devices without a j-box. Requires the use of a self-laminating wrap around label. Brady Label self-laminating 1.2" by 1.5" wrap around label Part #29689 (NO ACCEPTABLE EQUAL).
 - 3.20.1.3 On the cable at the terminal strip or pop-it prior to termination point. Requires the use of a self-laminating wrap around label. Brady Label self-laminating 1.2" by 1.5" wrap around label Part #29689 (NO ACCEPTABLE EQUAL).
 - 3.20.1.4 The label shall be clearly defined with a minimum #10 font size.
 - 3.20.2 Hand written labels are not permitted. Where cable ID includes room number identification, the Contractor shall obtain written verification of final room numbers prior to beginning labeling (numbers on plans do not always match final room numbers). Cable pulling cross reference lists will not be accepted with final documentation.
 - 3.20.3 Labeling will follow recommended identification standards or District Standards as directed by the customer. Contractor will confirm labeling pattern prior to final identification or testing. All device identification designations shall match the final identification information shown on the Final As-Built Drawings. Contractor shall be required to have the labeling scheme approved in writing by the District Facilities Director prior to manufacture or installation of the labeling.

3.20.4 All OSP-rated cables routed through underground conduits shall be tagged with waterproof label tags in every manhole or pullbox. Waterproof label tags shall also be placed at each end of the cable in the termination closets or terminal cabinets in clear view at the point where the conduit transitions up out of the slab or where the conduit enters the terminal cabinet. A minimum of (2) tags are required in each handhole or manhole.

3.20.5 Refer to detail drawings for additional labeling requirements

3.21 Final System Acceptance

3.21.1 The system will be accepted only after a satisfactory test of the entire system has been accomplished by a Factory-Trained Contractor in the presence of the Owner's Representative. This contractor shall provide all personnel, ladders and testing equipment to assist in completing this test. Actuate each device and verify that the system performs as specified.

3.21.2 Once the system has been tested, the contract shall not be considered complete until after District training has been completed. The Contractor shall notify in writing their intent to provide the training for the system. This notification shall be given to the Architect and the Project Engineer a minimum of two weeks prior to the scheduled training session. The 28 13 00 Contractor shall be responsible for notifying the District to confirm that the appropriate District personnel will be made available for this training session. If the District does not receive confirmation that the training session can be performed on the proposed date, than another time shall be provided. The training shall consist of the following:

3.21.2.1 Provide a minimum of one (1) two-to-four-hour training period located at the project site, to instruct District personnel in proper operation of all systems.

PART 4 – CLOSE-OUT DOCUMENTATION

4.1 Final As-Built Drawing Submittals - Provide (1) hard bound copy of "E-size" As-Built drawings and (3) copies on USB Flash Drive in AutoCAD (2014 or newer version) format. A Hand marked-up copy of the original construction drawings will not be accepted as the final As-Built drawing submittal. Final As-Built drawings shall include copies of the floor plan drawings of each building, detailed elevations of each MDF or IDF locating all equipment, quantities devices and locations, locations of all sleeves and identification of all final cable routes. In addition, the drawings shall include all device locations with unique cable identification numbers.

END OF SECTION 281300

SECTION 282300 - VIDEO SURVEILLANCE SYSTEM**PART 1 – GENERAL**

- 1.1 Contractor shall provide additional cameras to the existing campus-wide video surveillance system. Furnish all materials, equipment and labor, and perform all operations in connection with video surveillance system work as indicated on the drawing, as specified herein and required to complete the work. The video surveillance system for the Elementary School Campus shall be managed by the MVUSD IT Department. The new cameras shall be tied into the existing District-wide Video Surveillance System. The video surveillance system cameras that shall be centrally controlled from the MVUSD District Offices.
- 1.2 Related Specification Sections:
- 1.2.1 Section 28 01 00 - General Provisions
- 1.2.2 Section 26 05 33 - Conduit and Fitting
- 1.2.3 Section 26 05 19 - Conductors
- 1.2.4 Section 26 05 34 - Outlet and Junction Boxes
- 1.3 All security video surveillance system components and wiring shall be furnished and installed by a factory authorized Contractor and Distributor. The Contractor shall hold a C10 or C7 license from the State of California for the purpose of installing surveillance systems. The Contractor shall meet the requirement of the 28 23 00 Section for warranted installations.
- 1.4 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.
- 1.4.1 Subcontractors will not be approved for the installation of any portion the video surveillance systems, except those noted in these specifications.

- 1.5 All cameras provided by the Contractor must match existing system components currently installed on the campus and approved by the District IT Department. **The District Standard Cameras shall be as manufactured by i-Pro (No Approved Equal).** Different manufacturers will not be considered equal.

- 1.5.1 Contractor Training and Certifications;

- 1.5.1.1 The Contractor must possess a minimum I-Pro Silver Level Channel Partner Certification with the I-Pro Certified Professional Staff Training Certificates listed below.

1.5.1.2 Contractor must be able to offer extended warranties and all licensing requirements from the manufacturer for the cameras installed.

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1.5.1.3 Contractor's Installation Technicians shall be actively involved in the installation process on the project job site and shall possess a minimum of the I-Pro Security Technical Training Certification and have attended the I-Pro Technical Training Workshop.

1.5.1.4 The Contractor shall have during the installation process, a minimum of (1) Lead Technician possessing Certified Training on the I-Pro Video Insight video management software.

1.5.1.5 All persons holding certifications working on the project site shall have been an employee of the company for a minimum of 6 months prior to the award of the project.

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1.6 The District's existing video surveillance software is I-Pro Video Insight. The Contractor shall confirm with the District IT Department which version of the software is to be locally installed and which version is currently on the Main System Server at the District Offices. The Contractor shall update the provided local campus software suite to match the District's Central Server software as required to support the cameras that are part of this project.

1.6.1 The Contractor shall furnish all of the MAC addresses of the cameras to the District IT Department as soon as possible upon receipt of the cameras.

1.7 The Network Infrastructure portion of the project shall be completed by the 27 10 00 Contractor. Coordinate with the 27 10 00 Contractor for the locations of the data cables for the network cameras. The 28 23 00 Contractor shall install all patch cables in the IDF Closet and at the camera location. Refer to the camera section for additional instructions.

1.8 Acceptable camera and accessory manufacturers shall be as shown in this specification.

1.9 Equipment manufactured by any other manufacturers not listed in these specifications have been reviewed and are not considered equal or approved for use on this project. Equivalent products for items listed with "or equal" must be submitted, reviewed and approved by the Project Engineer before they are considered an equal for the item specified, and approved substitutions shall be included in the Contractor's submittal package.

1.10 The handholes, junction boxes, conduit, outlets, terminal cabinets, device backboxes, etc., which form a part of the rough-in work, shall be furnished and installed complete by the Division 26 Contractor.

1.11 Provide 3-year extended equipment and installation warranty on all active video surveillance components including cameras and servers. **If the individual product does not carry a 3-year warranty, the Contractor shall include the extended warranty required to meet the requirement from the manufacturer.** Contractor originated warranties on manufactured components will not be accepted as equal.

- 1.12 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; warranties; 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.
- 1.13 Phase 2 Submittal shall be made within (10) working days after the award of the contract by the District. This submittal shall include the following:
- 1.13.1 Complete bills of quantities, including all materials, components, devices, and equipment required for this work. The bills of quantities shall be tabulated respective of each and every system as specified, and shall contain the following information for each item listed:
- 1.13.1.1 Description and quantity of each item.
- 1.13.1.2 Manufacturer's Name and Model Number.
- 1.13.1.3 Manufacturer's Specification Sheet.
- 1.13.1.4 Description of any specialty backbox requirements.
- 1.13.1.5 All wiring types required for installation of this system.
- 1.13.1.6 Extended warranty documentation
- 1.14 The Murrieta Valley Unified School District’s Main Offices, located at 41870 McAlby Court, Murrieta, CA 92562, shall be considered the District's central control point for all cameras and servers within the District Campus-wide Surveillance System. Contractor shall provide any programming required for the overall administrative tasks associated with the project, to be provided from this location and any local programming required for the cameras on the server in the MDF Room of the new campus.
- 1.15 The Contractor shall set up and coordinate meetings for interviews with the District IT Director or Approved Contact, Local Campus Police Supervisor and the Campus Administrative Staff to confirm the exact coverage area for each camera. The Contractor shall document the camera coverages from those meetings and use the information to set up and focus the cameras. Time and labor for this function shall be included in the Contractor’s bid.

PART 2 – PRODUCTS

Video Surveillance System – General Requirements

- 2.1 The Video Surveillance System is an IP-based delivery system utilizing digital network cameras for surveillance of the campus and adjacent grounds. Contractor shall be responsible for providing all components of the cameras including, but not limited to; cameras, lenses, housings, mounts, cabling (except Network Infrastructure provided by the 27 10 00 Contractor), power supplies, software, programming and support hardware.

- 2.2 The District shall be responsible for providing the POE network switch ports required to operate the Ethernet connections to the cameras. Programming of the switch ports for the additional cameras shall be set up by the District IT Department and final programming of the camera management software within the virtual network shall be completed by the Contractor. Coordinate all IP Addressing with the District IT Department.
- 2.3 IP cameras will be powered via PoE (Power over Ethernet) unless otherwise noted. Camera types and models are listed in the specifications.

Video Surveillance Server Requirements

- 2.4 The Contractor shall furnish and install the video surveillance server in the MDF Room equipment racks. Coordinate final location of the server with the District IT Department. The server shall be furnished to provide 30 days storage for all cameras plus a minimum of 25% for future expansion. Cameras shall record at a minimum of 5 frames per second @1080P resolution. Storage shall automatically overwrite older files. Contractor shall coordinate final storage requirements for each camera prior to programming.

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- 2.5 Provide I-Pro Video Surveillance NVR Server pre-loaded with the I-Pro Video Insight Software. Server shall be provided as “Plug and Play” ready for installation. Server shall be provided with a minimum of 48TB of Total Storage (32TB Usable), 16GB of RAM, with a single processor and single power supply. Server shall be as manufactured by Lenovo, I-Pro Model # NVR-RL-1-48TB-V3 (or Approved Equal).

- 2.6 The Contractor shall provide software, server and programming as a turn-key application. The Contractor shall include all associated components to properly connect to the server and mount it in the equipment rack. Provide video output cable to connect to the LCD Monitor Shelf KVM Switch Combo in the equipment provided by the 271000 Contractor. Coordinate with the 271000 Contractor to determine the length of the patch cable required.
- 2.7 Contractor shall include camera licensing costs in the bid proposal. Contractor shall furnish all camera licenses for the cameras shown in the project drawings plus 20% spare license for future camera locations. Contractor shall provide the District IT Department with all license and registration information with the final documentation submittals.
- 2.8 The District shall furnish all network switches in the MDF Racks as required for the installation of the cameras. Contractor shall provide the District IT Department with a quantity of POE switch ports required and all addressing information. .

Video Surveillance Software

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- 2.9 Video surveillance software shall be as manufactured by I-Pro Insight Version 7. Provide any software updates with the delivery package as required to complete the installation with the latest versions of software package.
- 2.10 Contractor shall program the video surveillance operational software on the sever at the local campus as required to provide a complete turn-key installation. Contractor shall also be responsible for setting programming for all camera locations including, but not limited to; blanking or masking parameters, dynamic range adjustments, recording parameters,

coverage areas, scheduled and pre-alarm event management, playback and search parameters, access and control groups for multiple users, Administrative access per District IT Department instructions, etc. Contractor will responsible for interviewing the Client for information regarding programming requirements and shall include a minimum of 6 man-hours with the Contractor's Programmer. Contractor shall provide meeting minutes of the interview to the Project Engineer, Architect, Construction Manager and the District Project Manager.

- 2.11 The Contractor shall load all user interface software on the local computers and wireless devices of the Staff and Campus Police or Security that will be monitoring the video surveillance system cameras for the campus. The Contractor shall be responsible for setting up any programming, or fine tuning, to allow the user to access the system per their pre-determined level of access, as required by the District IT Director, Campus Administration and the Campus Police or Security Officers.

Cameras and Enclosures

Networked Multi-Sensor Cameras

- 2.12 Provide quantity of cameras as shown in project drawings. Refer to both the floor plans and the site plans for a complete count of all cameras as some cameras may be located in remote areas. The Contractor shall provide a complete turn-key installation of all cameras and provide all accessories, including mounts for each of the camera locations. The cameras shall be connected to the District's Ethernet switches in the MDF/IDF Rooms. Each camera's storage requirements shall be recorded at the frame rate required by the District.
- 2.13 Cameras shall be installed in a clear dome vandal resistant, weather-tight housing with mount as required for the mounting location shown on the drawings. See detail drawings for additional camera mounting requirements. Power for camera and housings shall be provided from the POE switch located in the MDF/IDF closet. Contractor shall furnish and install all cabling and mounting hardware for the camera installation. All fasteners and mounting hardware shall be vandal resistant stainless steel.

- 1** 2.14 Provide i-Pro (formerly Panasonic) Business Series Multi-Sensor Camera – Model WV-X8571N (No Approved Equal) for all camera locations shown on the drawings. The camera shall be furnished with the following features;

2.14.1 4 X 4K (33MP) iA H.265 High Multi-Sensor Camera, Super Dynamic Range 108dB

- 1** 2.14.2 Four high image quality 4K image sensors producing a resolution of 3,840 x 2,160 pixels at up to 15 fps, H.265 Smart Coding, iA (intelligent Auto)

2.14.3 Four repositionable lenses with wide range tilt angle mechanism minimizing blind spots

2.14.4 Full encryption SD card edge recording - SDXC/SDHC/SD Memory Card - H.265 / H.264 recording: Manual REC / Alarm REC (Pre/Post) / Schedule

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REC / - Contractor shall furnish and install (1) 64GB I-Pro SDXC Card for each camera for back-up

- 2.14.5 FIPS 140-2 Level 1 compliant
- 2.14.6 1x Optical Zoom – Three Levels of 1x, 2x and 4x Digital Zoom
- 2.14.7 Vandal resistant outdoor housing and Polycarbonate Resin Dome, IP66 and IK10 rated
- 2.14.8 Type 4X (UL50) and NEMA 4X Compliant
- 2.14.9 Video Compression – H.265 (Constant bit rate / VBR / Frame rate / Best effort), JPEG
- 2.14.10 Minimum illumination - Color: 0.12 lx, BW : 0.05 lx (F1.6, Maximum shutter : Off (1/30s), AGC : 11) // Color : 0.008 lx, BW : 0.003 lx (F1.6, Maximum shutter : max. 16/30s, AGC : 11)
- 2.14.11 Focal Length 4.6 mm with Maximum Aperture Ratio of 1:1.6
- 2.14.12 Image Compensation – Adaptive black stretch, Back light compensation (BLC), High light compensation (HLC), Fog compensation, Digital noise reduction
- 2.14.13 Adjusting Angle of View – Camera Sensors 1, 2 and 3: Horizontal (PAN) angle : 360 ° Vertical (TILT) angle : +30 ° to + 80 ° Azimuth (YAW) angle : ±50 °*
- 2.14.14 Adjusting Angle of View – Camera Sensor 4: Horizontal (PAN) angle : 360 ° Vertical (TILT) angle : –15 ° to + 80 ° Azimuth (YAW) angle : ±50 °*
- 2.14.15 *Adjusting Angle of View – The above is the adjustable range of a single camera. The adjustable range of each camera varies according to the positional relationship with other cameras.
- 2.14.16 Angular Field of View: Horizontal - 97 ° Vertical - 53 °
- 2.14.17 Power Consumption – Maximum 17W (IEEE802.3at) POE+; 12.95W (IEEE802.3af) POE
- 2.14.18 Minimum Object Distance – 3 Meters (9.84 Feet)
- 2.14.19 1/1.8” CMOS Image Sensors
- 2.14.20 Network Fuctionality; 10Base-T/100 Base-TX/1000-Base T, RJ45 Connector
- 2.14.21 Tamper resistant hardware for both mount and enclosure

- 2.15 Provide all mounting adapters, strapping and vandal resistant hardware, per the specifications, detail drawings and manufacturer’s recommendations. See detail drawings

for additional requirements. Route cabling through mounts adapter to camera. Contractor shall be responsible for field modifications required to adapt the camera mounts to the building's interior and exterior surfaces.

General Camera Installation Requirements

- 2.16 Cameras and mounts shall be furnished and installed by the Contractor. The Contractor shall be responsible for all mounting hardware and any additional support materials. Contractor shall also be responsible for providing and installing any specialized mounting requirements as required to properly mount the cameras and provide the proper coverage area. Contractor shall refer to the floor plans and drawing details for additional requirements.
- 2.17 Contractor must field verify and confirm all camera heights with the Project Engineer and the District IT Director prior to installation of any cameras. The Contractor shall submit a spreadsheet detailing the camera location, proposed mounting height, camera mount type, proposed adapters (as required).
- 2.18 Contractor shall submit camera heights and confirm coverage patterns for the cameras to the District IT Director and the Project Engineer (JCE) prior to installation of the conduit or cameras.
- 2.19 The Contractor shall be responsible aiming all cameras and confirming coverage for the cameras until the project is signed off by the District IT Director. The camera coverage areas shall coincide with the information derived from the meetings with the local Campus Administration and Police Officer.

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- 2.20 Fiber Optic Cable Runs with Ruggedized Ethernet Switches – The 27 10 00 Contractor shall install the fiber optic feed cable from the IDF Room to the designated Lighting Pole Base with the Pole Base Junction Box shown on the drawings. The Ruggedized Ethernet Switches shall be furnished and installed by the 28 23 00 Contractor.
 - 2.20.1 Provide an Unmanaged Ruggedized Ethernet Switch in the NEMA 3R enclosure as shown on site plan for both fiber optic and copper cable connections to the Second Floor IDF Closet in the New Classroom Building. Refer to the drawings and specifications for Fiber Optic Cable type furnished by the 27 10 00 Contractor to the Parking Light Pole Base from the IDF-Closet. Provide switch with the following requirements;
 - 2.20.2 Premium Outdoor Rated (Up to 75° C) Ruggedized Edge Switch - With (2) 50/125um Multimode “LC” Fiber Optic Ports and (4) 10/100 RJ45 POE Ethernet Ports (built-in) with 48VDC Power Adapter by Belden GarrettCom. Provide Outdoor Ruggedized Model #PES42P-2MLC-48VDC with 48VDC Power Adapter. (Switch must be furnished with 48V Power Supply to operate properly and provide POE Power to the Ethernet Ports. The 12VDC Power connection ONLY powers the switch and does not provide any POE Power).
 - 2.20.3 Contractor shall furnish and install 48VDC POE Power Supply for Ruggedized POE Ethernet Switch as manufactured by American FiberTek, Inc. Model #PS-

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4860B (Or Approved Equal). Install Power Supply in Base J-Box and connect output to the input power terminals on the Ethernet Switch.

2.20.4 The 28 23 00 Contractor shall furnish and install all Category-6 Patch Cables for the connections to the Camera in the Base Junction Box.

2.20.5 Plug terminated Fiber Optic Cable directly into POE Ethernet Switch. Two Strands of the Fiber Cable shall be used and Two Strands shall be stored for future use. All Fibers shall be terminated by the 27 10 00 Contractor. Provide Velcro Ties inside J-Box and neatly store fiber cable as shown in the drawing detail.

2.20.6 Mount POE Switch in J-Box with Velcro Ties as shown in the Drawing Details. Refer to the E1 series Details for requirements.

2.21 Ethernet/POE extenders shall be provided for camera locations outside of the Category-6 UTP cable distance limitations, Unless Otherwise noted. Unless otherwise noted, cameras requiring the Ethernet/POE extenders shall be determined and furnished per the following requirements;

2.21.1 Provide a 1000-MBPS POE Extender kit for each camera installed beyond the distance limitation. The POE Extender transmitter and power supply shall be placed the IDF closet and the receiver shall be placed at the camera location. The Contractor shall install the receiver in the weather-tight junction box enclosure at the pole base. Refer to the drawing details for more information on the pole and J-Box. Connect from the POE Extender receiver to the camera.

2.21.2 POE Extender kit shall be furnished with a 4-year warranty.

2.21.3 Extender shall be capable of extending the POE power and 1000 Mbps Ethernet signal up to 3000 feet.

2.21.4 Provide POE Extender Kit as manufactured by "Enable-It" – Model # Enable-IT-865XS PRO Gigabit POE Extender Kit or approved equal. Each Kit shall include (1) IT-865X PRO CO Unit; (1) 12V-1A DC wall power adapter for CO Unit; (1) IT-360 56v-61W 802.3at Gigabit POE+ Injector for the power to the cameras; (2) 10' Black Ethernet patch cords; (1) IT-865XS PRO CPE Remote 4-Port Output unit; Provide one kit per Exterior Camera location.

2.21.5 If the camera location is on or within an outdoor pedestal or light pole, substitute the IT-865 PRO CPE Remote 4-Port Output unit with the IT-865W PRO CPE Remote 2-Port Output unit.

2.21.6 Install the IT-865XS PRO CO unit and the IT-360 Gigabit POE+ Injector in the MDF/IDF location. Connect the IT-360 Gigabit POE+ Injector to the College furnished Ethernet switch with the provided patch cable. Connect the IT-865XS PRO CO unit to the IT-360 Gigabit POE+ Injector and to the patch panel port for the data cable run with Contractor furnished category-6 patch cables, length as required.

Additional Scope of Work, Labor and Materials

- 2.22 The Contractor shall provide in their bid (8) labor hours for re-adjustment of the cameras on the school's campus six weeks (to be scheduled by mutual agreement between Contractor and District) after the initial installation is completed. The labor shall include all tools and miscellaneous materials required to re-aim, re-focus or re-program the new cameras. The adjustments may be required as the campus reviews the use of the cameras after installation. Labor provision shall not include drive time to the locations. The Contractor shall keep a log of the work completed and the hours used for this portion of the contract and submit it to Construction Manager and Project Engineer for approval before final payment of the project can be released.
- 2.23 In addition to the installation of the cameras and adjustment allowance, the Contractor shall document all operational cameras on the as-built drawings and what the camera identification names or numbers shown in the software system.

Accessories and Mounts

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- 2.24 Provide corner mount adapters for wall mount applications, where required, for proper coverage per the camera locations on the drawings. The corner mount adapters shall be as manufactured by I-Pro Model #WV-QCN500-W (No Approved equal) (This mount requires Wall Mount Bracket #WV-QWL501-W to mount Camera)
- 2.25 Provide wall mount adapters for wall mount applications, where required, for proper coverage per the camera locations on the drawings. The wall mount adapters shall be as manufactured by I-Pro Model #WV-QWL501-W (No Approved equal)
- 2.26 Provide camera adapters for wall mount applications, to be provided with all #WV-QWL501-W wall mount adapters, for proper attachment to the mount and camera. The camera adapters shall be as manufactured by I-Pro Model #WV-QSR502A-W (No Approved equal)
- 2.27 Provide ceiling mount adapters for direct attachment to a 2-Gang Junction Box in the ceiling for the ceiling mount applications shown on the drawings. The ceiling mount adapter shall be as manufactured by I-Pro Model #WV-QJB501-W (No Approved equal). The ceiling mount adapter shall be provided for all locations that are to be mounted to the underside of an exterior soffit, exterior overhang or interior hard-lid ceiling application.
- 2.28 Provide Pole Mount Adapter for cameras on Exterior Lighting Poles where shown on the Floor Plans. The Pole Mount Camera Adapters shall be as manufactured by i-Pro Model #WV-QPL500-W (No Approved equal) (This mount requires Wall Mount Bracket #WV-QWL501-W to mount Camera)
- 2.29 The Contractor shall use the manufacturer provided adapters provided with the camera to as required to properly install the camera. Refer to the manufacturer's installation instructions for additional requirements and guidelines.
- 2.30 All camera enclosures shall be securely anchored to the wall or ceiling as shown in the drawing details. Fasteners shall be rated for twice the combined weight of camera and mounts.

PART 3 – EXECUTION

- 3.1 All connections throughout the system shall be crimped or fastened with screw type terminals or made by spring tension clip "punch block" terminals or made by standard connectors and bulkheads. Each wire twisted pair or cable shall be tagged throughout the site with EZ markers with the room number it serves. All conductors in terminal cabinets shall be carefully formed and harnessed in a workmanlike manner.
- 3.2 All camera system cabling shall be installed in conduit where indicated on the drawings or where routed exposed and shall be open wiring where routed above accessible ceilings or in walls.
- 3.3 Locations of cameras as shown on the electrical plans are diagrammatic only. Prior to beginning installation, Contractor shall schedule a site coordination meeting with the District and Project Engineer to confirm the exact locations.
- 3.4 Labeling
 - 3.4.1 Each cable run shall be permanently labeled at each end with a unique sequential number which corresponds to a similar number provided for each data outlet and punch down point. A printed label shall be placed at each of the following locations;
 - 3.4.1.1 On the cable at the rear of the patch panel or termination block. Requires the use of a self-laminating wrap around label. Brady Label self-laminating 1.2" by 1.5" wrap around label Part # 29689 (NO ACCEPTABLE EQUAL).
 - 3.4.1.2 On each cable in the j-box behind the faceplate location. Requires the use of a self-laminating wrap around label. Brady Label self-laminating 1.2" by 1.5" wrap around label Part # 29689 (NO ACCEPTABLE EQUAL).
 - 3.4.1.3 On the face of the patch panel, provide a 3/4" by 3/4" label with a letter or number identifying the patch panel designation.
 - 3.4.1.4 On the termination block in the base of the camera housing.
 - 3.4.2 Hand-written labels are not permitted. Where cable ID includes room number identification the Contractor shall obtain written verification of actual room numbers 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.
 - 3.4.3 Each patch panel port shall be identified with a unique sequential labeling scheme. Port identification labeling pattern shall be consistent throughout the project.
 - 3.4.4 All cables shall be identified with permanent printed labels. Labels must not be subject to removal by incidental contact. Contractor shall be responsible for

replacing defective labeling for a period of one year from date of final sign-off of project.

- 3.4.5 Labeling will follow recommended EIA/TIA standards or as requested by the customer. Contractor will confirm labeling pattern prior to final identification or testing. All test results will be identified by the final labeling scheme.
- 3.4.6 All cameras shall be labeled with permanent type written labels with the naming convention agreed upon by the District while programming the software system. The names on the labels will match the names that appear on the screen of the viewing station when the camera image or video is accessed. The labels shall be a minimum of ½" in height and shall be placed in a location visible from the ground.
- 3.4.7 Refer to detail drawings for additional labeling requirements.
- 3.5 Contractor shall coordinate IP addressings and access to the District's network with the District IT Administrator. It is the Contractor's responsibility to set-up, program, and test all features for the camera's software and functionality. District IT Department shall provide PoE Network Switch Ports as necessary to service the IP cameras at the IDF Room location.
- 3.6 Final Systems Acceptance
 - 3.6.1 The system will be accepted only after a satisfactory test of the entire system has been accomplished by a Factory-Trained Contractor in the presence of the Project Engineer and the District's Representative. The Contractor shall provide all personnel, ladders and testing equipment to assist in completing this test.
 - 3.6.2 Provide a minimum of two (2) complete as built sets of drawings for the District records, including (1) copy on a USB Flash Drive of the updated AutoCAD plans including all ASI, Change Orders and Field Modifications.
 - 3.6.3 The As-Built drawings shall show the camera locations, cable paths, MDF/IDF locations, camera labels and naming conventions, switch port assignments and IP Addresses.
 - 3.6.4 Upon completion of testing cable links, the Contractor shall supply a copy of the original database files downloaded from the tester in original format on disk. Contractor shall provide with database files an original copy of the tester's manufacturer software program (included in original cost) for record management and archiving, in a Windows format (e.g., MicroTest's software program - ScanLink ver.)

END OF SECTION 282300

SECTION 283001 - FIRE ALARM VOICE EVACUATION SYSTEM

PART 1 – GENERAL

1.1 Work Included:

- 1.1.1 Furnish and install all equipment, accessories, and materials in accordance with these specifications and drawings to provide a complete and operating fire alarm system.

1.2 Related Work:

- 1.2.1 Division 26 01 00: Electrical General Provisions
- 1.2.2 Division 26 05 33: Conduit and Fittings
- 1.2.3 Division 26 05 34: Outlet and Junction Boxes

1.3 The equipment and installation shall comply with the current applicable provisions of the following standards:

NFPA 72-2016. National Fire Alarm Code with California Amendments.
CBC - 2019. California Building Code (CBC), Part 2, Title 24, CCR.
CEC - 2019. California Electrical Code, (CEC), Part 3, Title 24, CCR.
CFC - 2019. California Fire Code (CFC), Part 9, Title 24, CCR.

1.4 The system and all components shall be listed by Underwriters Laboratories, Inc. for use in Fire Protective Signaling Systems under the following standards as applicable:

UL 38 Manually Actuated Signaling Boxes.
UL 50 Cabinets and Boxes.
UL 268 Smoke Detectors for Fire Protective Signaling Systems.
UL 268A Smoke Detectors for Duct Applications
UL 346 Waterflow Indicators for Fire Protective Signaling Systems.
UL 464 Audible Signaling Appliances.
UL 521. Heat Detectors for Fire Protective Signaling Systems.
UL 864 Control Units for Fire Protective Signaling Systems.
UL 1481. Power supplies for Fire Protective Signaling Systems.
UL 1971. Visual Signaling Appliances.

1.5 Only Fire Alarm Control Panel Equipment and Peripheral Field Devices have been shown on the Contract Bid Single Line Block Diagram. Specific and complete wiring between Control Equipment and Peripheral Equipment has been deleted for clarity.

- 1.6 Submittal shall be made **in accordance with Division 26 01 00 – Shop Drawings and Submittals.** This submittal shall include the following:

1.6.1 Complete bills of quantities, including all materials, components, devices, wiring and equipment required for this work. The bills of quantities shall be tabulated respective of each and every system as specified, and shall contain the following information for each item listed:

- 1.6.1.1 Quantity of each type of equipment item.
- 1.6.1.2 Quantities of 10% spare devices as per 1.16.
- 1.6.1.3 Description of each item.
- 1.6.1.4 Manufacturer's Name and Model Number.
- 1.6.1.5 Manufacturer's Specification Sheet.
- 1.6.1.6 Back box type and dimensions per device type.
- 1.6.1.7 California State Fire Marshall Listing Sheets for all components.
- 1.6.1.8 Equipment items which have individual components, will require that all component parts be listed individually.
- 1.6.1.9 Letter indicating the contractor's intent to comply with Phase II submittal drawings.

- 1.7 Phase II Submittal shall be provided **within (20) working days** after the approval of the Phase I submittals and prior to any fabrication or field conduit installations. All shop drawings shall be engineered and drawn on a CAD System. Each submission shall include 'D' or 'E' size print copies to match the contract drawings, and one (1) data disk copy with files in an AutoCAD 2000i or 2004 format. Building floor plan CAD files on disk, will be made available via express mail after the receipt of payment of \$50.00 per building floor plan, or \$300.00 minimum which ever is less. Contractor shall make the request for drawings in writing directly to Johnson Consulting Engineers, confirmation of the request and a release form will be forwarded to the contractor to include a signed copy with payment prior to release of files. Detail or riser diagram sheets or any other drawings other than floor or site plans, will not be made available to the contractor.

1.7.1 **Provide complete shop drawings to include the following:**

- 1.7.1.1 Complete floor plans, at scale of contract documents, showing the locations throughout the project of all devices, panels conduits, wireways, tray, pullboxes, junction boxes, number and type of conductors, and other devices.
- 1.7.1.2 Point to point wiring diagrams showing wiring from panel terminals to each device.
- 1.7.1.3 Riser diagram indicating all wiring and circuits.

- 1.7.1.4 Current State Fire Marshal listing sheets for all components and devices.
- 1.7.1.5 Provide battery power supply calculations, indicate point of power supply connection, means of disconnect, over-current protection, etc. for each panel.
- 1.7.1.6 Provide detailed information on conductors to be used- manufacturer, type, size, insulation, etc.
- 1.7.1.7 Provide voltage drop calculations for all conductor run is from each panel (i.e., main FACP, remotes, power extenders, etc.) for each panel.
- 1.7.1.8 Provide written sequence of system operation matrix.
- 1.7.1.9 Provide list of zones. (Every device that is addressable.)
- 1.7.1.10 Provide detailed drawing for annunciator panel indicating all zones and initiating devices.

1.8 **Common submittal mistakes which will result in submittals being rejected:**

- 1.8.1 Not including the qualifications of the installing contractor.
 - 1.8.2 Not including all items listed in the above itemized description.
 - 1.8.3 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
 - 1.8.4 Not including actual manufacturer's catalog information of proposed products.
 - 1.8.5 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.
- 1.9 All equipment and material shall be new and unused, and listed by Underwriter's Laboratories for the specific intended purpose. All control panel components and field peripherals shall be designed for continuous duty without degradation of function or performance. All equipment covered by this specification or noted on Installation. Drawings shall be equipment suited for the application and shall be provided by a single manufacturer or be recognized and UL listed as compatible by both manufacturers.
- 1.10 It will be the responsibility of the Contractor to ensure proper specification adherence for system operation, final connection, test, turnover, warranty

compliance, and after-market service. The distributor of the equipment specified must be factory-trained and certified.

- 1.11 Basic System Functional Operation, upon operation of any automatic, manual or other initiation device the following shall occur:
 - 1.11.1 The system alarm LED shall flash.
 - 1.11.2 A local piezo electric signal in the control panel shall sound.
 - 1.11.3 A backlit 80-character LCD display shall indicate all information associated with the fire alarm condition, including the alarm point and its location within the protected premises.
 - 1.11.4 History storage equipment shall log the information associated with each new fire alarm control panel condition, along with time and date of occurrence.
 - 1.11.5 All system output programs assigned via control by event equations to be activated by the particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.
 - 1.11.6 LED display and audible signaling at the remote annunciator indicating building, fire zone, and type of device. Annunciator shall also provide a separate audible signal for CO detection with a green flashing light, with classroom number indication.
 - 1.11.7 Automatic retransmission to a UL central station for fire department notification.
 - 1.11.8 Automatic shut down of air conditioning units shall be performed by control modules at each unit when required as part of a complete area coverage design scheme. Each building shall shut down all A/C units and dampers within that building as one zone.
- 1.12 All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by the State Fire Marshal for use as part of a protective signaling system.
- 1.13 All equipment and components shall be installed in strict compliance with manufacturer's recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.
- 1.14 All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place. Fasteners and supports shall be adequate to support the required load.

- 1.15 All wiring shall be installed in a conduit system.
- 1.16 The contractor shall provide as a part of this contract additional control modules, heat detectors, smoke detectors, CO detector, duct detectors, manual pull stations, strobes, speakers, speaker/strobes exterior speakers devices etc. along with all required programming, to equal 10% of the total quantity of devices shown on the drawings, or a minimum of three (3) for each type, whichever is greater. Installation of 50' of conduit, boxes and all wiring for each of the devices shall be included, and required locations coordinated with CSFM final approved shop drawings. Any devices not required to be included during construction shall be delivered to the District at the completion of the project. The quantities of these devices shall be listed as a part of the Phase I submittals.
- 1.17 The installing contractor shall provide a copy of current documentation, indicating that the contractor installing the fire alarm systems or devices and wiring, is certified by Underwriters Laboratories (UL) in its product directories under the listing category "PROTECTIVE SIGNALING SERVICES - LOCAL, AUXILIARY, REMOTE STATION, AND PROPRIETARY." The contractor shall be certified by the manufacturer to install and program the system. The contractor must also provide complete installation of all wiring and equipment, and software programming. Supervised installation of the wiring, devices and/or any software programming shall not be permitted.
- 1.17.1 The installing contractor must also be an "authorized dealer" by the equipment manufacturer and must have completed all required training prior to the bid of this project.
- 1.17.2 The fire alarm system installation shall be warranted by the manufacturer's representative.
- 1.17.3 The Contractor shall have a current California C-10 or C-7 Contractor's License, and all individuals working on this project shall have passed the Department of Industrial Relations Division of Apprenticeship Standards – "Fire / Life Safety Certification Program."
- 1.17.4 The installing contractor shall provide, at the time of submittal, a letter of intent to provide an extended service warranty. This warranty shall extend for a total of three (3) years, starting at the completion, testing, and training of this project. The service warranty shall cover all material and labor to keep operational all system devices installed under this project, and shall include two (2) complete U.L. system's tests and cleaning of all devices at year two (2) and year three (3) of the warranty. Routine cleaning of devices, other than at the two (2) specified U.L. system's testing periods, will not be included as a part of this warranty.

- 1.17.5 The installing contractor shall provide, at the time of submittal, a letter indicating that the installation crew for this project meets the following NICET certifications:
 - 1.17.5.1 25% of the installing field personnel must have completed NICET Level 2 Certification.
 - 1.17.5.2 One of the installing field personnel and /or supervisor must have completed NICET Level 3 Certification.
 - 1.17.5.3 Contractor shop drawings shall be signed by an individual who has completed NICET Level 4 Certification.
- 1.18 All conduit and standard backboxes will be furnished and installed by the Division 26 Contractor. Specialty boxes will be furnished by the equipment supplier to be installed by the Division 26 Contractor.
- 1.19 Equipment and materials shall be the standard product of **Notifier**.
- 1.20 Alternate equipment as manufactured by any other manufacturer not specifically listed above will not be approved for use on this project.
- 1.21 D.S.A approved drawings are included as a part of the drawing set.

PART 2 - PRODUCTS

- 2.1 Main Fire Alarm Control Panel:
 - 2.1.1 Fire alarm control panel shall be Notifier NSF2-3030.
 - 2.1.2 The system shall be controlled and supervised by a microprocessor based monitoring fire alarm control panel. The systems shall be addressable, field configurable, programmable and editable. The system shall continuously scan devices for change of status. Each device shall have its own unique address, but shall also be grouped by building as a separate zone for remote annunciation and alarm report purposes.
 - 2.1.3 The system shall be a fiber network and fiber cabling shall be single mode, with capabilities, software and modem to communicate with the District-wide diagnostic and annunciation network.
 - 2.1.4 The fire alarm control panel shall be housed in a lockable, code gauge steel cabinet with 80character LCD display, master controller operators panel, indicating lamps, silence switch and reset switch mounted on cabinet front. The fire alarm control panel shall be physically and visually located in the general office for monitoring by staff, and shall sound the "Voice Message" in all zones. Signal duration shall be field programmable and initially set at three minutes. Provide all control

modules, synchronous modules, etc., to provide a complete working system per all codes that apply.

- 2.1.5 The fire alarm control panel shall come with standardized software for on-site customization of the system. The unit shall be capable of providing a 600-event historical log with zone or point selectable alarm verification.
- 2.1.6 Provide a minimum 100 watts of amplification in each FACP with a minimum of 25% spare capacity.
- 2.1.7 The unit shall support a minimum of 3000 intelligent addressable points and one output point, SPST contact per zone. Provide the number of modules necessary to control and supervise fire alarm devices as shown on the Drawings, as well as to provide 25% spare capacity.
- 2.1.8 The unit shall also provide a minimum of (2) class B strobe circuits with additional circuits as indicated on the drawings.
- 2.1.9 The fire alarm control panel shall be capable of providing a walk test.
- 2.2 The power feed for the FACP shall be 3-wire, 120volt, AC, single phase (20A circuit) permanently labeled "FIRE ALARM CONTROL POWER", terminating at the master fire alarm control and supervisory panel. The label shall be red with 1/4" high white lettering. The source circuit breaker must be provided with a lock-on device.
- 2.3 In addition to the AC circuit, the panel shall be equipped with a DC battery to activate an audible alarm and pilot light in case of a power failure on the AC circuit.
- 2.4 The master fire alarm panel shall be equipped with a manual pull lever type, supervised report station.
- 2.5 With the exception of the manually operated report station required at the master fire alarm panel and large assembly areas, the remainder of the school facility shall be equipped with approved, electronically supervised, automatic fire detection devices, such that every room, space, including concealed spaces, such as the attic spaces above ceilings, etc., is provided with approved coverage.
- 2.6 REMOTE POWER SUPPLIES shall provide a minimum of (4) Class B NAC circuits.
- 2.7 SPEAKER / STROBE DEVICE shall be of the semi-flush type designed for mounting to a standard 4 11/16" deep electrical back box. Each device shall be provided with a semi-flush accessory plate. Exterior speakers shall be weatherproof. The strobe unit shall have a meantime between failure (MTBF) of 1,000 hours or greater. The strobe section shall have a minimum flash rate of

approximately one flash per second, with candela rating as per UL standard 1971. Housing shall be white.

2.7.1 In areas containing two or more audible devices, or three or more visual devices, these devices shall be synchronized, Per NFPA 72, Chapter 18 California Amendments (2019).

2.8 SPEAKERS shall operate at either 25 or 70 VRMS and provide tap setting from 1/8 to 2 watts and provide efficient design for high intelligibility at a minimum wattage across a frequency range of 300 to 8000 HZ and shall be white in color. Speakers shall be ADA, NFPA and ANSI compliant.

2.8.1 Speakers for typical classrooms shall be tapped at ¼ watt with exterior speakers tapped at 2 watts. Other areas such as Theaters, Auditoriums, Gymnasiums, Team Rooms, Cafeterias, Kitchens and all shop areas shall be tapped at ½ watt.

2.8.2 Contractor shall also include (2) additional site visits within the first year to adjust speaker output on a space by space basis as requested by the owner.

2.9 STROBES. The strobe unit shall have a meantime between failure (MTBF) of 1,000 hours or greater. The strobe section shall have a minimum flash rate of approximately one flash per second, with candela rating as per UL standard 1971. Housing shall be white.

2.9.1 In areas containing two or more audible devices, or three or more visual devices, these devices shall be synchronized, per NFPA 72, Chapter 18 California Amendments (2019).

2.9.2 Maximum pulse duration to be 0.20 of a second with an ADAAG 4.28.3(3). Visual alarms maximum duty cycle of 40%.

2.9.3 Capable of providing minimum candela. Intensity as shown on plans (effective strength measured at the source).

2.9.4 The flash rate to be a minimum of 1 Hz and a maximum of 2 Hz per NFPA 18.5.3.1.

2.10 HEAT DETECTOR DEVICES shall be analog addressable, fixed temperature x rate of rise, fixed at 200°F and a 15°F/min rate of rise. In janitor rooms equipped with kilns, devices shall be fixed at 200°F.

2.11 SMOKE DETECTOR DEVICES shall be analog addressable, photo-electric.

2.12 CO – CARBON MONOXIDE detectors shall be provided in all Group E Classrooms and provided with a sounder base to alarm individual classrooms

with a 4-pulse temporal pattern as well as transmitting a signal to the staffed remote annunciator.

- 2.13 **DIGITAL ALARM COMMUNICATOR TRANSMITTER.** The control panel shall meet the requirements of UL 864 for central station connections and shall be UL listed for use with the fire alarm control panel. The communicator shall be connected to supervise two telephone lines, all wiring required for this connection shall be provided by the fire alarm contractor Coordinate interface with District monitoring company as required.
- 2.14 **REMOTE ANNUNCIATOR** shall be an 80-character backlit, alphanumeric, LCD readout display. The display shall include alarm, supervisory, CO detection and trouble condition LEDs and tone alert. Each condition shall have a dedicated acknowledge push button switch to silence the local tone alert but leaves the LED lights on until all conditions have been restored.

PART 3 - EXECUTION

- 3.1 All wiring shall be (min) #18 AWG copper or as noted on drawings. All underground conductors shall be UL wet location rated for use in wet locations, West Penn “Aquaseal” or equal. There shall be no splices in underground handholes or vaults. A multi-conductor cable rated for use in wet locations will also be acceptable. It must be labeled “FIRE ALARM” in all pull boxes, using a water-tight labeling system.
- 3.2 Interior, dry location wiring for low voltage initiating circuits shall be #18 AWG copper, twisted shielded pair minimum, signaling circuits shall be No. 14 AWG minimum, and wiring for 120 volt circuits shall be No. 12 AWG minimum. All wiring shall be color coded, solid copper conductor. Use of power limited cable shall be restricted to controls listed for this purpose. Single conductors shall be type THHN/THWN-2 insulated copper.
- 3.3 Wire markers shall be provided for each wire connected to equipment. The marker shall be of the taped bank type, of permanent material, and shall be suitable and permanently stamped with the proper identification. The markers shall be attached in a manner that will not permit accidental detachment. Changing of wire colors within circuits shall be unacceptable.
- 3.4 A terminal cabinet shall be installed in the electric room for the fire alarm systems at each building. All fire alarm wiring shall terminate on UL approved strips in this terminal cabinet. All wiring shall be labeled at each termination strip. Wiring shall be configured such that all end-of-line resistors will be installed at the terminal cabinet.
- 3.5 Fire Sprinkler Activation detecting System(s) shall each be indicated on a separate zone in the fire alarm control panel.

- 3.6 Fire Alarm Control Panel and all other equipment shall be mounted with the center of all operable reset buttons, located a maximum of 48" front approach / 54" side approach above floor level.
- 3.7 Contractor shall provide complete wiring between all equipment.
- 3.8 The Fire Alarm/Life Safety Installation shall comply fully with all Local, State and National Codes, and the Local Authority Having Jurisdiction (AHJ) DSA.
- 3.9 The Fire Alarm Control Panel and power supply shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the Panelboard as FIRE ALARM CIRCUIT.
- 3.10 The Control Panel Cabinet shall be grounded securely to a power system ground conductor. Provide a 1/2-inch conduit and 1#12 grounding conductor to the building electrical service ground bus.
- 3.11 Conduit shall enter into the Fire Alarm Control Panel back box only at those areas of the back box which have factory conduit knockouts.
- 3.12 All field wiring shall be completely supervised. In the event of a primary power failure, disconnected standby battery, removal of any internal modules, or any open circuits in the field wiring; an audible and visual trouble signal will be activated until the system and its associated field wiring are restored to normal condition.
- 3.13 All cables and wiring shall be listed for Fire Alarm/Life Safety use and shall be of the type as required by and installed per CEC Article 760.
- 3.14 Final System Acceptance
 - 3.14.1 Provide an NFPA Certificate of Compliance to DSA and the engineer of record. Complete fire alarm system shall comply with Chapter 14 of NFPA for testing and inspection and be sound-tested for audibility in all spaces requiring voice evacuation. This testing shall be performed in the presents of the project electrical engineer. Adjust speaker taps or provide additional speakers as required to provide correct audibility.
 - 3.14.2 The system will be accepted only after a satisfactory test of the entire system has been accomplished by a Factory-Trained Distributor in the presence of a representative of the authority having jurisdiction and the Owner's representative. This contractor shall provide all personnel, ladders and testing equipment to assist the local authority in completing this test. Actuate each device and verify that the system performs as specified.

- 3.14.3 The Contractor will present a complete set of "as-built" Fire Alarm/Life Safety system drawings, and the factory supplied Operator's Manuals as required by the General Provisions section of this specification.
- 3.14.4 Once the system has been tested and the certificate of compliance completed, the contract shall not be considered complete until after owner training has been completed. The contractor shall notify in writing their intent to provide the training for the system. This notification shall be given to the Division 21 Contractor, Architect and the Project Engineer a minimum of 2 weeks prior to the scheduled training session. The Division 21 Contractor and/or the architect shall be responsible for notifying the owner to confirm that the appropriate District personnel will be made available for this training session. If the Division 21 Contractor does not receive confirmation that the training session can be performed on the proposed date, then another time shall be provided. The training shall consist of the following:
 - 3.14.4.1 Provide a minimum of one (1) four-to-six -hour training period located at the project site, to instruct District personnel in proper operation of all systems.
 - 3.14.4.2 Provide a minimum of three (3) complete owner operation manuals for the District records.
 - 3.14.4.3 Provide a minimum of two (2) complete as built sets of drawings for the District records.
 - 3.14.4.4 Provide all spare parts as described in part 1 of these specifications
 - 3.14.4.5 Provide written confirmation and proposed scheduled dates for follow up training and 1-year complete system test.

3.15 Follow up Training

- 3.15.1 Provide as a part of this contract, the follow up instructional training period within six (6) months after the final acceptance of the systems. This training shall include a minimum of one four-to-six-hour training period to instruct District personnel in proper operation of all systems and shall instruct the District technicians how to repair any non-operational parts of the system as required. All defective parts shall be replaced at no cost to the owner.

END OF SECTION 283001

SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Protecting existing vegetation to remain.
 - 2. Removing existing vegetation.
 - 3. Clearing and grubbing.
 - 4. Stripping and stockpiling topsoil.
 - 5. Removing above- and below-grade site improvements.
 - 6. Disconnecting, capping or sealing, and removing site utilities
 - 7. Temporary erosion- and sedimentation-control measures.
- B. Related Sections:
 - 1. Section 015000 "Temporary Facilities and Controls" for temporary utility services, construction and support facilities, security and protection facilities
 - 2. Section 017300 "Execution" for field engineering and surveying.
 - 3.
 - 4. Section 024119 "Selective Structure Demolition" for partial demolition of buildings or structures.

1.3 DEFINITIONS

- A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.
- C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.
- D. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.
- E. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.
- F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

- A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 INFORMATIONAL SUBMITTALS

- A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
 - 1. Use sufficiently detailed photographs or videotape.
 - 2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.
- B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site

1.7 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
 - 1. Do not proceed with work on adjoining property until directed by Architect.
- C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises.
- D. Utility Locator Service: Notify utility locator service> for area where Project is located before site clearing.
- E. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.
- F. The following practices are prohibited within protection zones:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Parking vehicles or equipment.
 - 3. Foot traffic.
 - 4. Erection of sheds or structures.
 - 5. Impoundment of water.
 - 6. Excavation or other digging unless otherwise indicated.
 - 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- G. Do not direct vehicle or equipment exhaust towards protection zones.
- H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.
- I. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."
 - 1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly identify trees, shrubs, and other vegetation to remain Wrap a 1-inch blue vinyl tie tape flag around each tree trunk at 54 inches above the ground.
- C. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.
- B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
- D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

- A. General: Protect trees and plants remaining on-site according to requirements in Section 015639 "Temporary Tree and Plant Protection."
- B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.

3.4 EXISTING UTILITIES

- A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.
 - 1. Verify that utilities have been disconnected and capped before proceeding with site clearing.
- B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
 - 1. Arrange with utility companies to shut off indicated utilities.

- C. Locate, identify, and disconnect utilities indicated to be abandoned in place.
- D. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify District Construction Manager not less than **five** days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Architect's written permission.
- E. Excavate for and remove underground utilities indicated to be removed.
- F. Removal of underground utilities is included in earthwork sections and with applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security and utilities sections and Section 024116 "Structure Demolition" and Section 024119 "Selective Structure Demolition."

3.5 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
 - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 - 2. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches below exposed subgrade.
 - 3. Use only hand methods for grubbing within protection zones.
 - 4. Chip removed tree branches and dispose of off-site.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
 - 1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil **to depth of** 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.
 - 1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
 - 1. Limit height of topsoil stockpiles to 72 inches.
 - 2. Do not stockpile topsoil within protection zones.
 - 3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
 - 4. Stockpile surplus topsoil to allow for resspreading deeper topsoil.

3.7 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
 - 2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
- B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 311000

SECTION 312000 - EARTH MOVING

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. Preparing subgrades for slabs-on-grade walks pavements turf and grasses and plants.
 - 2. Excavating and backfilling for buildings and structures.
 - 3. Drainage course for concrete slabs-on-grade.
 - 4. Subbase course for concrete walks pavements.
 - 5. Subbase course[and base course] for asphalt paving.
 - 6. Subsurface drainage backfill for walls and trenches.
 - 7. Excavating and backfilling trenches for utilities and pits for buried utility structures.
 - 8. Excavating well hole to accommodate elevator-cylinder assembly.
- B. Related Sections:
 - 1. Section 013200 "Construction Progress Documentation" Section 013233 "Photographic Documentation" for recording preexcavation and earth moving progress.
 - 2. Section 015000 "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities; also for temporary site fencing if not in another Section.
 - 3. Section 033000 "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
 - 4. Section 142400 "Hydraulic Elevators" for excavating well hole to accommodate elevator-cylinder assembly.
 - 5. Section 311000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
 - 6. Section 329300 "Plants" for finish grading in planting areas and tree and shrub pit excavation and planting.

1.3 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
 - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.
- C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
 2. Bulk Excavation: Excavation more than [10 feet in width and more than [30 feet in length.
 3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.
- H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,700 lbf and stick-crowd force of not less than 18,400 lbf with extra-long reach boom; measured according to SAE J-1179.
 2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp flywheel power and developing a minimum of 47,992-lbf breakout force with a general-purpose bare bucket; measured according to SAE J-732.
- I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- J. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- K. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- L. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following manufactured products required:
1. Geotextiles.
 2. Controlled low-strength material, including design mixture.
 3. Geofoam.
 4. Warning tapes.
- B. Samples for Verification: For the following products, in sizes indicated below:
1. Geotextile: 12 by 12 inches.
 2. Warning Tape: 12 inches long; of each color.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.

- B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
 - 1. Classification according to ASTM D 2487.
 - 2. Laboratory compaction curve according to ASTM D 1557.
- C.
- D. Seismic survey report from seismic survey agency.
- E. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

1.6 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.
- B. Preexcavation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
 - 1. Do not proceed with work on adjoining property until directed by Architect.
- C. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth moving operations.
- D. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in Section 015000 "Temporary Facilities and Controls," Section 311000 "Site Clearing," are in place.
- E. Do not commence earth moving operations until plant-protection measures specified in Section 015639 "Temporary Tree and Plant Protection" are in place.
- F. The following practices are prohibited within protection zones:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Parking vehicles or equipment.
 - 3. Foot traffic.
 - 4. Erection of sheds or structures.
 - 5. Impoundment of water.
 - 6. Excavation or other digging unless otherwise indicated.
 - 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- G. Do not direct vehicle or equipment exhaust towards protection zones.
- H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487 , or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487], or a combination of these groups.
 - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.
- F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.
- I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.
- J. Sand: ASTM C 33; fine aggregate.
- K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 - 1. Survivability: Class 2; AASHTO M 288.
 - 2. Grab Tensile Strength: 157 lbf; ASTM D 4632.
 - 3. Sewn Seam Strength: 142 lbf; ASTM D 4632.
 - 4. Tear Strength: 56 lbf; ASTM D 4533.
 - 5. Puncture Strength: 56 lbf; ASTM D 4833.
 - 6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.

7. Permittivity: 0.2 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 247 lbf; ASTM D 4632.
3. Sewn Seam Strength: 222 lbf; ASTM D 4632.
4. Tear Strength: 90 lbf; ASTM D 4533.
5. Puncture Strength: 90 lbf; ASTM D 4833.
6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.3 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:
1. Red: Electric.
 2. Yellow: Gas, oil, steam, and dangerous materials.
 3. Orange: Telephone and other communications.
 4. Blue: Water systems.
 5. Green: Sewer systems.
- B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
1. Red: Electric.
 2. Yellow: Gas, oil, steam, and dangerous materials.
 3. Orange: Telephone and other communications.
 4. Blue: Water systems.
 5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXPLOSIVES

- A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
 - 2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
 - a. 24 inches outside of concrete forms other than at footings.
 - b. 12 inches outside of concrete forms at footings.
 - c. 6 inches outside of minimum required dimensions of concrete cast against grade.
 - d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - e. 6 inches beneath bottom of concrete slabs-on-grade.
 - f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.
- B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Architect. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract Time may be authorized for rock excavation.
 - 1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.
 - a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.
 - 2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:
 - a. 24 inches outside of concrete forms other than at footings.
 - b. 12 inches outside of concrete forms at footings.
 - c. 6 inches outside of minimum required dimensions of concrete cast against grade.
 - d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - e. 6 inches beneath bottom of concrete slabs-on-grade.
 - f. 6 inches beneath pipe in trenches, and the greater of [24 inches wider than pipe or 42 inches wide.

3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
 - 2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
 - 3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.
- B. Excavations at Edges of Tree- and Plant-Protection Zones:
 - 1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
 - 2. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
 - 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.
 - 1. Clearance: 12 inches each side of pipe or conduit
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
 - 1. For pipes and conduit less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
 - 2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
 - 3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
 - 4. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
- D. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
- E. Trenches in Tree- and Plant-Protection Zones:
 1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
 2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
 3. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.8 EXCAVATION FOR ELEVATOR CYLINDER

- A. Drill well hole plumb in elevator pit to accommodate installation of elevator-cylinder assembly. Coordinate with applicable requirements for diameter and tolerances in Section 142400 "Hydraulic Elevators."
- B. Provide well casing as necessary to retain walls of well hole.

3.9 SUBGRADE INSPECTION

- A. Notify Project Inspector when excavations have reached required subgrade.
- B. If Testing Agency determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
 2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.10 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.
 1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.11 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.12 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
 - 2. Surveying locations of underground utilities for Record Documents.
 - 3. Testing and inspecting underground utilities.
 - 4. Removing concrete formwork.
 - 5. Removing trash and debris.
 - 6. Removing temporary shoring and bracing, and sheeting.
 - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.13 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 "Cast-in-Place Concrete"
- D. Trenches under Roadways: Provide 4-inch- thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Section 033000 "Cast-in-Place Concrete"
- E. Backfill voids with satisfactory soil while removing shoring and bracing.
- F. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.
 - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- G. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the pipe or conduit. Coordinate backfilling with utilities testing.
- H. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- I. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.14 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use satisfactory soil material.
 - 3. Under steps and ramps, use engineered fill.

4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.15 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.16 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:
 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at **95** percent.
 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at **90** percent.
 3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at **85** percent.
 4. For utility trenches, compact each layer of initial and final backfill soil material at **85** percent.

3.17 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 1. Provide a smooth transition between adjacent existing grades and new grades.
 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 1. Turf or Unpaved Areas: Plus or minus 1 inch.
 2. Walks: Plus or minus 1 inch.
 3. Pavements: Plus or minus 1/2 inch.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.18 SUBSURFACE DRAINAGE

- A. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
 - 1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698
- B. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
 - 1. Place and compact impervious fill over drainage backfill in 6-inch-thick compacted layers to final subgrade.

3.19 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase course[and base course under pavements and walks as follows:
 - 1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 - 2. Place base course material over subbase course under hot-mix asphalt pavement.
 - 3. Shape subbase course and base course to required crown elevations and cross-slope grades.
 - 4. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
 - 5. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 - 6. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.
- C. Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 1557].

3.20 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
 - 1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 - 2. Place drainage course 6 inches or less in compacted thickness in a single layer.
 - 3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.

4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.21 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
 2. Determine that fill material and maximum lift thickness comply with requirements.
 3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.
- B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
- E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
 1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
 2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length, but no fewer than two tests.
 3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.
- F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.22 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.23 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.
- B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.
 - 1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

SECTION 31 22 00

GRADING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This Section compliments and shall be coordinated with Civil Drawing specifications / requirements. The most stringent requirements shall be utilized.
- B. Removal and storage of topsoil.
- C. Rough grading and consolidation/compaction the site for site structures, building pads, and related site work.
 - 1. Preparation for excavation, trenching, backfilling and compacting Work.
- D. Excavation of subsoil, stockpiling for later reuse, and removal of excess from the site.
- E. Preparing of subgrade for walks, pavements and site retaining walls.
- F. Excavating, backfilling and compaction for wet utility lines.
- G. Finish grading.

1.02 RELATED REQUIREMENTS

- A. Section 01 40 00 - Quality Requirements.
- B. Section 01 70 00 - Execution and Closeout Requirements.
- C. Section 31 10 00 - Site Clearing.
- D. Section 31 23 16 - Excavation.
- E. Section 31 23 16.13 - Trenching: Trenching and backfilling for utilities.
- F. Section 31 23 23 - Fill: Filling and compaction.
- G. Section 32 12 16 - Asphalt Paving.
- I. Section 32 13 13 - Concrete Paving.
- J. Section 32 93 00 - Plants: Topsoil in beds and pits.

1.03 SUBMITTALS

- A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.
 - 1. Accurately record location of all changes in finish elevations and gradients which materially affect drainage.

1.04 QUALITY ASSURANCE

- A. Regulatory Requirements: For conditions not covered in this Section, refer to applicable provisions of the California Building Code (CBC), Chapter 18A - Soils and Foundations, as amended and adopted by authorities having jurisdiction.
- B. Perform Work in accordance with local of, Public Works Department standards.
 - 1. Maintain one copy on site.

1.05 PROTECTION

- A. Dust Control: Comply with requirements specified in Section 01 50 00 - Temporary Facilities and Controls.
- B. Protection:
 - 1. Comply with general requirements specified in Section 01 50 00 - Temporary Facilities and Controls.
 - 2. Provide protection for walks, curbs, drains, and trees and boxing around corners of existing buildings to prevent damage.
 - 3. Keep adjacent roads, streets and drives clear of dirt and debris from earthwork operations.
- C. Underground Utilities:
 - 1. Buried utility lines may exist.
 - 2. If such are encountered, notify Construction Manager, Architect and Owner and for directions to be followed for preservation, relocation or demolition of utilities.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Topsoil: See Section 31 23 23.
- B. Subsoil: Excavated material, graded free of lumps larger than 3-inches, rocks larger than 6-inches, and debris; or in accordance with trench backfill requirements.
- C. Other Fill Materials: See Section 31 23 23.
- D. Shoring and Bracing: Provide all materials and services necessary to properly engineer and construct shoring for excavations. Selection of materials and design of shoring, underpinning and bracing of new and existing structures shall be solely the responsibility of the Contractor.
 - 1. Shoring design shall comply with State of California Trenching and Shoring Manual issued by Offices of Structure Construction; 2011.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey bench mark and intended elevations for the Work are as indicated.
- B. The Drawings do not purport to show all below-grade conditions and objects on the site.
- C. Upon discovery of unknown utility or concealed conditions, discontinue affected Work and notify Construction Manager, Architect and Owner for direction. Unforeseen conditions shall be resolved in accordance with the General Conditions.

3.02 PREPARATION

- A. Identify required lines, levels, contours, and datum. See requirements specified in Section 01 70 00 - Execution.
- B. Stake and flag locations of known utilities.
- C. Locate, identify, and protect from damage above- and below-grade utilities to remain.

1. Maintain and protect existing utilities remaining which pass through Project area.
- D. Notify utility company to remove and relocate utilities, as required.
- E. Protect site features to remain, including but not limited to bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs, from damage by grading equipment and vehicular traffic.
- F. Protect trees to remain by providing substantial fencing around entire tree at the outer tips of its branches; no grading is to be performed inside this line.
- G. Protect plants, lawns, and other features to remain as a portion of final landscaping.

3.03 ROUGH GRADING

- A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.
- B. Do not remove topsoil when wet.
- C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.
- D. Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.
- E. When excavating through roots, perform work by hand and cut roots with sharp axe.
- F. See Section 31 23 23 for filling procedures.
- G. Benching Slopes: Horizontally bench existing slopes greater than 5:1 (H:V) to key fill material to slope for firm bearing.
- H. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.04 SOIL REMOVAL AND STOCKPILING

- A. Topsoil Excavation:
 1. Stockpile topsoil to be re-used on site; remove remainder from site.
 2. Do not excavate wet topsoil.
- B. Subsoil Excavation:
 1. Excavate subsoil from areas to be filled with topsoil, to construct foundations, footings, slabs on grade, paving and to achieve final finish grades.
 2. Stockpile subsoil to be re-used on site; remove remainder from site.
 3. Do not excavate wet subsoil.
 4. Over-excavate to working elevations for backfilling and compaction operations.
 5. Over-excavate to provide suitable space and access for Work. Do not excavate into normal 45-degree influence line of bearing of footings without written direction from Architect. Generally, footings require additional depth and other provisions to avoid interference.
 6. Underpin adjacent structures, paving and other existing features which may be damaged by excavation Work, including utilities and pipe chases.
 7. Remove all lumped subsoil, boulders and rock in excess of 6 inch (150 mm) in greatest dimension.
 8. Stockpile subsoil on site for backfill, if soil is appropriate. Stockpile subsoil to depth not exceeding 8-feet. Remove from the site excess subsoil not to be reused.

9. When excavation through roots is necessary, perform work by hand and cut roots with a sharp axe.
 10. Grade top perimeter of excavations to prevent surface water from draining into excavation. Provide dewatering of excavations as required to ensure suitable conditions for concrete and backfilling operations.
 11. Hand trim excavations to accurate configurations and depths. Remove loose matter.
 12. Machine slope banks of excavations to minimum 1 to 1 ratio horizontal to vertical or angle of repose, if less, until shored. Slope must comply with local codes, ordinances and requirements of agencies having jurisdiction.
 13. Where excavations are made to a depth greater than that indicated, such additional depth shall be filled with concrete having the same compressive strength as specified for the footing. Correct unauthorized and erroneous excavation at no change in Contract Time or Contract Sum.
 14. Protect excavations from cave-in and from loose soil and other matter from falling in. Comply with all applicable industrial safety regulations.
 15. All permanent cut or fill slopes shall have a maximum slope of 2:1 (H:V) ratio, horizontal to vertical and shall comply with applicable requirements of the California Building Code (CBC).
- C. Stockpiles: Use areas designated on site; pile depth not to exceed 8 feet (2.5 m); cover to protect from erosion.

3.05 GRADING

- A. Uniformly grade areas as shown on Drawings to tolerances specified below. Evenly grade between points where elevations are shown or between points of Work and existing grades.
- B. Slope grade away from building perimeter at gradient indicated.
 1. Slope shall be not less 1/4 inch per foot or 2 percent in unpaved areas.
- C. Make grade changes gradual. Blend slopes into level areas.

3.06 FINISH GRADING

- A. Before Finish Grading:
 1. Verify building and trench backfilling have been inspected.
 2. Verify subgrade has been contoured and compacted.
- B. Remove debris, roots, branches, stones, in excess of 1/2 inch (13 mm) in size. Remove soil contaminated with petroleum products.
- C. Where topsoil is to be placed, scarify surface to depth of 3 inches (75 mm).
- D. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 6 inches (150 mm).
- E. Place topsoil in areas indicated.
- F. Place topsoil where required to level finish grade.
- G. Place topsoil to thickness as scheduled.
- H. Place topsoil during dry weather.
- I. Remove roots, weeds, rocks, and foreign material while spreading.

- J. Near plants spread topsoil manually to prevent damage.
- K. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.
- L. Lightly compact placed topsoil.

3.07 TOLERANCES

- A. Top Surface of Subgrade: Plus or minus 0.10 foot (1-3/16 inches) (30 mm) from required elevation.
- B. Top Surface of Finish Grade: Plus or minus 0.04 foot (1/2 inch) (13 mm).
- C. Top Surface Under Paving: Plus or minus 1/2-inch (0.05-foot) from required elevation.
- D. Top Surface Under Footings and Foundations: Plus 0, minus 0.2 foot.
- E. Top Surface Under Slabs on Grade: Plus 0, minus 1/2-inch (0.05-foot).

3.08 REPAIR AND RESTORATION

- A. Existing Facilities, Utilities, and Site Features to Remain: If damaged due to this work, repair or replace to original condition.
- B. Trees to Remain: If damaged due to this work, trim broken branches and repair bark wounds; if root damage has occurred, obtain instructions from Architect as to remedy.
- C. Other Existing Vegetation to Remain: If damaged due to this work, replace with vegetation of equivalent species and size.

3.09 FIELD QUALITY CONTROL

- A. See Section 31 23 23 for compaction density testing.
- B. Field Quality Control: Field inspections and testing shall be performed in accordance with requirements specified in Section 01 40 00 - Quality Requirements. Make required quality control submittals in accordance with requirements specified.
- C. Non-compliance: Should grade elevations, tests of fill or backfill indicate non-compliance with required elevations or density, Contractor shall over-excavate, recompact and retest until specified grade or density is obtained.
 - 1. Costs and Time associated with remedial Work and retesting shall be in accordance with provisions of the General Conditions.
 - 2. Retesting to demonstrate compliance shall be by a testing laboratory acceptable to Owner and shall be at Contractor's expense.

3.10 CLEANING

- A. Remove unused stockpiled topsoil and subsoil. Grade stockpile area to prevent standing water.
- B. Leave site clean and raked, ready to receive landscaping.

3.11 PROTECTION

- A. Protect completed grading from erosion from weather and traffic.
- B. Over-excavate and recompact areas damaged by construction activities and weather.

END OF SECTION

SECTION 31 23 16

EXCAVATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Excavating for building volume below grade, footings, slabs-on-grade, paving, site structures, and utilities within the building.
- B. Trenching for utilities outside the building to utility main connections.

1.02 RELATED REQUIREMENTS

- A. Section 01 40 00 - Quality Control: Inspection of bearing surfaces.
- B. Section 01 50 00 - Temporary Construction Facilities and Controls: Dewatering excavations and water control.
- C. Section 01 70 00 - Execution and Closeout Requirements: General requirements for dewatering of excavations and water control.
- D. Section 31 22 00 - Grading: Soil removal from surface of site.
- E. Section 31 22 00 - Grading: Grading.
- F. Section 31 23 16.13 - Trenching: Excavating for utility trenches outside the building to utility main connections.
- G. Section 31 23 23 - Fill: Fill materials, filling, and compacting.

1.03 PROJECT CONDITIONS

- A. Verify that survey bench mark and intended elevations for the Work are as indicated.

1.04 COORDINATION OF SPECIFICATION REQUIREMENTS

- A. Coordinate these Specification Section requirements with specifications included on Drawings. Comply with more stringent requirements and with those requirements of authorities having jurisdiction.
- B. Comply in full with the direction (recommendations) given in the Geotechnical Report.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey bench mark and intended elevations for the work are as indicated.

3.02 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. See Section 31 22 00 for additional requirements.

3.03 EXCAVATING

- A. Underpin adjacent structures that could be damaged by excavating work.
- B. Excavate to accommodate new structures, construction operations, and paving/site structures.
- C. Shoring and Bracing: Provide all materials and services necessary to properly engineer and construct shoring for excavations. Selection of materials and design of shoring, underpinning and bracing of new and existing structures shall be solely the responsibility of the Contractor.
 - 1. Shoring design shall comply with State of California Trenching and Shoring Manual issued by Offices of Structure Construction; 2011.
- D. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- E. Slope banks of excavations deeper than 4 feet (1.2 meters) to angle of repose or less until shored, per Cal/OSHA requirements for Type C Soil.
 - 1. Machine slope banks to angle of repose or less, until shored.
- F. Do not interfere with 45 degree bearing splay of foundations.
- G. Cut utility trenches wide enough to allow inspection of installed utilities.
- H. Hand trim excavations. Cut through tree roots with a sharp axe. Remove loose matter.
- I. Remove lumped subsoil, boulders, and rock up to 1/3 cu yd (0.25 cu m) measured by volume.
- J. At no additional cost, correct areas that are over-excavated and load-bearing surfaces that are disturbed; see Section 31 23 23.
- K. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- L. Remove excavated material that is unsuitable for re-use from site.
- M. Stockpile excavated material to be re-used in area designated on site in accordance with Section 31 22 00.
- N. Remove excess excavated material from site.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection and testing.
- B. Provide for visual inspection of load-bearing excavated surfaces before placement of foundations.
- C. Scarification, over excavation and all other excavations will be subject to the approval of the Soils Engineer.

3.05 PROTECTION

- A. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.
- B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

END OF SECTION

SECTION 31 23 16.13

TRENCHING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Backfilling and compacting for utilities from 5 FEET outside the building to utility main connections.

1.02 RELATED REQUIREMENTS

- A. Section 31 22 00 - Grading: Site grading.
- B. Section 31 23 16 - Excavation: Building and foundation excavating.
- C. Section 31 23 23 - Fill: Backfilling at building and foundations.
- D. Section 33 11 16 - Site Water Distribution Piping: Potable Water Systems.
- E. Section 33 31 11 - Site Sanitary Sewerage Systems: Sewer piping from building to municipal sewer.
- F. Section 33 41 11 - Site Storm Drainage System: Storm drainage piping from building to municipal storm drain system.

1.03 DEFINITIONS

- A. Finish Grade Elevations: Indicated on drawings.
- B. Subgrade Elevations: Indicated on drawings.

1.04 REFERENCES

- A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials; 2010
- B. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2013 is current; use 2003 as indicated in 2013 CBC Referenced Standards.
- C. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2014.
- D. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2007.
- E. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)); 2012.
- F. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.
- G. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2010

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Comply with the requirements listed in Section 31 23 23 - Fill.

- C. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- D. Compaction Density Test Reports.

1.06 COORDINATION OF SPECIFICATION REQUIREMENTS

- A. Coordinate these Specification Section requirements with specifications included on Drawings. Comply with more stringent requirements and with those requirements of the authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. When necessary, store materials on site in advance of need.
- B. When fill materials need to be stored on site, locate stockpiles where designated.
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.
 - 3. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.01 FILL MATERIALS

- A. For fill materials see Section 31 23 23 - Fill.
- B. For bed materials see Section 31 23 23 - Fill.
- C. General Fill: Subsoil excavated on-site.
- D. Structural Fill: Subsoil excavated on-site.
- E. Concrete for Fill: As specified in Section 03 30 00; compressive strength of 2500 psi (17.235 MPa).
- F. Granular Fill - Gravel: Pit run washed stone; free of shale, clay, friable material and debris.
 - 1. Graded in accordance with ASTM C136, within the following limits:
 - a. 3/4 inch (19 mm) sieve: 95 to 100 percent passing.
- G. Granular Fill - Pea Gravel: Natural stone; washed, free of clay, shale, organic matter.
 - 1. Grade in accordance with ASTM D2487 Group Symbol GM.
- H. Sand: Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter.
 - 1. Grade in accordance with ASTM D2487 Group Symbol SW.
- I. Topsoil: Topsoil excavated on-site.
 - 1. Select.
 - 2. Graded.
 - 3. Free of roots, rocks larger than 1/2 inch (12 mm), subsoil, debris, large weeds and foreign matter.
 - 4. Acidity range (pH) of 5.5 to 7.5.
 - 5. Containing a minimum of 4 percent and a maximum of 25 percent inorganic matter.
 - 6. Conforming to ASTM D2487 Group Symbol OH.

2.02 SOURCE QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for testing and analysis of soil material.
- B. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.
- C. If tests indicate materials do not meet specified requirements, change material and retest.
- D. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey bench marks and intended elevations for the work are as indicated.

3.02 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. See Section 31 22 00 for additional requirements.

3.03 TRENCHING

- A. Excavate subsoil required for conduits, storm drain, sanitary sewer, water and gas piping to municipal utilities.
- B. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- C. Slope banks of excavations deeper than 4 feet (1.2 meters) to angle of repose or less until shored.
- D. Do not interfere with 45 degree bearing splay of foundations.
- E. Cut trenches wide enough to allow inspection of installed utilities.
- F. Hand trim excavations. Remove loose matter.
 - 1. Hand trim for bell and spigot pipe joints.
- G. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.
- H. Remove lumped subsoil, boulders, and rock up to 1/3 cu yd (0.25 cu m) measured by volume.
- I. Remove excavated material that is unsuitable for re-use from site.
- J. Stockpile excavated material to be re-used in area designated on site in accordance with Section 31 22 00.
- K. Remove excess excavated material from site.

3.04 PREPARATION FOR UTILITY PLACEMENT

- A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.
- B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

- D. Support pipe and conduit during placement and compaction of bedding fill.

3.05 BACKFILLING

- A. Backfill to contours and elevations indicated using unfrozen materials.
- B. Fill up to subgrade elevations unless otherwise indicated.
- C. Employ a placement method that does not disturb or damage installed piping and conduits, or other work.
- D. Systematically fill and compact to achieve 90 percent relative compaction without damaging conduit or pipe. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches (150 mm) compacted depth.
- G. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches (200 mm) compacted depth or as directed by the Geotechnical Report.
- H. Slope grade away from building minimum 2 inches in 10 ft (50 mm in 3 m), unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- I. Correct areas that are over-excavated.
 - 1. Thrust bearing surfaces: Fill with concrete.
 - 2. Other areas: Use general fill, flush to required elevation, compacted to minimum 90 or 95 percent of maximum dry density as applicable for the fill area.
- J. Compaction Density Unless Otherwise Specified or Indicated:
 - 1. Under paving, slabs-on-grade, and similar construction: 95 percent of maximum dry density.
 - 2. At other locations: 90 percent of maximum dry density.
- K. Reshape and re-compact fills subjected to vehicular traffic.

3.06 BEDDING AND FILL AT SPECIFIC LOCATIONS

- A. Use general fill unless otherwise specified or indicated.
- B. Utility Piping, Conduits, and Duct Bank:
 - 1. Bedding: Use Fill Type SP or SW (ASTM D2487) or SM with sand equivalent of 30 or greater per ASTM D2419, 3 inches thick, compacted to 90 percent.
 - 2. Cover with Fill Type SP, SW, SM, GM per ASTM D2487.
 - 3. Fill up to subgrade elevation.
 - 4. Compact in maximum 8 inch (200 mm) lifts to 95 percent of maximum dry density.
 - 5. Gas Piping: As required by the Gas Company.
- C. Power Conduits Beyond Power Co. Transformer:
 - 1. Bedding: Use Fill Type SP or SW (ASTM D2487) or SM with sand equivalent of 30 or greater per ASTM D2419, 3 inches thick, compacted to 90 percent.
 - 2. Cover with Fill Type SP, SW, SM, GM per ASTM D2487.
 - 3. Fill up to subgrade elevation.
 - 4. Compact in maximum 8 inch (200 mm) lifts to 95 percent of maximum dry density.

- D. Over Sub-drainage Piping at Foundation Perimeter and Under Slabs:
 - 1. Drainage fill and geotextile fabric
 - 2. Cover drainage fill with general fill.
 - 3. Compact to 95 percent of maximum dry density.

3.07 TOLERANCES

- A. Top Surface of General Backfilling: Plus or minus 1.2 inch (30 mm) from required elevations.
- B. Top Surface of Backfilling Under Paved Areas: Plus or minus 1.2 inch (30 mm) from required elevations.

3.08 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Control, for general requirements for field inspection and testing.
- B. Perform compaction density testing on compacted fill in accordance with ASTM D1556 or ASTM D6938.
- C. See Section 31 23 23 for compaction density testing.
- D. Correct unauthorized excavation at no cost to Owner.
- E. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 1557 ("modified Proctor") or AASHTO T 180.
- F. If tests indicate work does not meet specified requirements, remove work, replace and retest at no additional cost to Owner.
- G. Correct areas over excavated by error in accordance with Section 31 23 23 - Fill.
- H. Frequency of Tests: See Section 31 22 00 - Grading.

3.09 CLEANING

- A. Leave unused materials in a neat, compact stockpile.
- B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.
- C. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

3.10 PROTECTION OF FINISHED WORK

- A. Protect finished Work under provisions of Section 01 50 00 - Temporary Construction Facilities and Controls.
- B. Recompect fills subjected to vehicular traffic.

END OF SECTION

SECTION 31 23 23

FILL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Filling, backfilling, and compacting for building volume below grade, footings, slabs-on-grade, paving, and site structures.
- B. Backfilling and compacting for utilities outside the building to utility main connections.
- C. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete.
- B. Section 31 22 00 - Grading: Site grading.
- C. Section 31 23 16 - Excavation: Removal and handling of soil to be re-used.
- D. Section 31 23 16.13 - Trenching: Excavating for utility trenches outside the building to utility main connections.

1.03 DEFINITIONS

- A. Finish Grade Elevations: Indicated on drawings.
- B. Subgrade Elevations: Indicated on drawings.

1.04 REFERENCE STANDARDS

- A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials; 2010
- B. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2013 is current; use 2003 as indicated in 2013 CBC Referenced Standards.
- C. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2007.
- D. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)); 2012.
- E. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.
- F. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2010.
- G. Geotechnical Report.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Samples: 10 lb (4.5 kg) sample of each type of fill; submit in air-tight containers to testing laboratory.

1. Submit samples directly to Geotechnical Engineer for testing and analysis copy transmittals to Architect and Owner.
- C. Materials Sources: Submit name of imported materials source.
- D. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- E. Compaction Density Test Reports.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. When necessary, store materials on site in advance of need.
- B. When fill materials need to be stored on site, locate stockpiles where agreed to.
 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 2. Prevent contamination.
 3. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.01 FILL MATERIALS

- A. All fill materials shall be in conformance with the approved Soils Report, addenda and geotechnical data.
- B. General Fill: Subsoil excavated on-site.
 1. Graded.
 2. Free of lumps larger than 3 inches (75 mm), rocks larger than 6 inches (150 mm), and debris.
 3. Conforming to ASTM D2487 Group Symbol SP, SW, SM, or GM.
- C. Structural Fill: Subsoil excavated on-site.
 1. Graded.
 2. Free of organic matter, debris, and lumps larger than 3 inches (75 mm), rocks larger than 6 inches (150 mm). Fill shall contain at least fifty percent of material smaller than 1/4-inch in size.
 3. Imported fill materials: The soil shall be tested for potential contamination in accordance with DTSC protocols.
 4. On-site soils should only be used as specified in the Soils Report.
 5. Conforming to ASTM D2487 Group Symbol SP, SW, SM, or GM.
 6. Fill (SP, SW per ASTM D2487) may be used for structural backfill at the Contractor's option. However, sand shall not be placed within one foot of finished surface elevation. Material shall be free of perishable or spongy matter, trash, and all other vegetation.
- D. Concrete for Fill: As specified in Section 03 30 00; compressive strength of 2500 psi (17.235 MPa); except concrete used under footings and foundations to correct over-excavation shall be same as for footings and foundation.
- E. Granular Fill - Gravel - Fill Type GM, GW: Angular crushed washed stone; free of shale, clay, friable material and debris.
 1. Class 2 Aggregate base per CT202 and Section 26-1.02B.

2. Graded in accordance with ASTM D2487 Group Symbol GM or GW.
- F. Granular Fill - Pea Gravel: No. 84 or 89 stone per ASTM C33.
- G. Sand: Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter.
 1. Grade in accordance with ASTM D2487 Group Symbol SP or SW.
- H. Topsoil: Topsoil excavated on-site.
 1. Select.
 - a. The soil shall be tested for potential contamination in accordance with DTSC protocols.
 2. Graded.
 3. Free of roots, rocks larger than 1/2 inch (12 mm), subsoil, debris, large weeds and foreign matter.
 4. Acidity range (pH) of 5.5 to 7.5.
 5. Containing a minimum of 4 percent and a maximum of 25 percent inorganic matter.
 6. Conforming to ASTM D2487 Group Symbol OH.
 7. Limit decaying matter to 5 percent of total content by volume.
- I. Blended Material: Conforming to type II material per the Uniform Standard Specifications for Public Works Construction, Off-Site Improvements.
- J. Select Fill: Excavated granular materials with not more than 10% passing the No. 200 sieve; free from lumps, clay, organic materials and rocks greater than 3 inches..
- K. Type F - Subsoil: Reused, free of rocks larger than 3 inch size, and debris.

2.02 SOURCE QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for testing and analysis of soil material.
- B. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.
- C. If tests indicate materials do not meet specified requirements, change material and retest.
- D. Provide materials of each type from same source throughout the Work.
- E. Comply with EPA/DTSC requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify structural or other backfill materials to be reused or imported are acceptable to the satisfaction of the Geotechnical Engineer. Approval shall be obtained in advance of re-use or importation onto the site.
 1. The soil shall be tested for potential contamination in accordance with DTSC protocols.
 2. Imported fill materials shall be compatible with on-site soils in addition to being suitable for its intended use.
 3. Imported fill soil shall contain no rocks larger than 6 inch (150 mm) maximum dimension or as allowed by the Geotechnical Report and shall be predominantly granular in nature.

- B. Verify that survey bench marks and intended elevations for the Work are as indicated.
- C. Identify required lines, levels, contours, and datum locations.
- D. See Section 31 22 00 for additional requirements.
- E. Verify sub-drainage, damp-proofing, or waterproofing installation has been inspected.
- F. Verify structural ability of unsupported walls to support imposed loads by the fill.
- G. Verify underground tanks are anchored to their own foundations to avoid flotation after backfilling.

3.02 PREPARATION

- A. Scarify subgrade surface to a depth of 6 inches (150 mm) to identify soft spots.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with Type II (Greenbook) or concrete fill and compact to density equal to or greater than requirements for subsequent backfill material.
- C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- D. Prior to placement of aggregate base course material at paved areas, compact subsoil to 95 percent of its maximum dry density in accordance with ANSI/ASTM D1557.
- E. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.03 FILLING

- A. Fill to contours and elevations indicated using unfrozen materials.
- B. Fill up to subgrade elevations unless otherwise indicated.
- C. Employ a placement method that does not disturb or damage other work.
 - 1. Do not disturb or damage foundation perimeter drainage and foundation waterproofing and protective cover utilities in trenches.
- D. Systematically fill and compact per geotechnical report. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches (150 mm) compacted depth.
- G. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches (200 mm) compacted depth.
- H. Slope grade away from building minimum 2 inches in 10 ft (50 mm in 3 m), unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- I. Correct areas that are over-excavated.
 - 1. Load-bearing foundation surfaces: Fill with concrete.
 - 2. Other areas: Use general fill, flush to required elevation, compacted to minimum 90 or 95 percent of maximum dry density in subgrade zone.
- J. Compaction Density Unless Otherwise Specified or Indicated:
 - 1. Under paving, slabs-on-grade, and similar construction: 95 percent of maximum dry density.
 - 2. At other locations: 90 percent of maximum dry density.

- K. Reshape and re-compact fills subjected to vehicular traffic.
- L. Remove surplus fill and backfill materials from site.

3.04 FILL AT SPECIFIC LOCATIONS

- A. Use general fill unless otherwise specified or indicated.
- B. Structural Fill:
 - 1. Use general fill.
 - 2. Fill up to subgrade elevations.
 - 3. Maximum depth per lift: 6 inches (150 mm), compacted.
 - 4. Compact to minimum 95 percent of maximum dry density.
- C. Under Interior Slabs-On-Grade:
 - 1. Use granular fill. Type A or B.
 - 2. Depth: 4 inches (100 mm) deep.
 - 3. Compact to 95 percent of maximum dry density.
 - 4. Cover with sand.
 - a. Depth: 2 inches (50 mm).
 - b. Compact to 95 percent of maximum dry density.
- D. At Footings:
 - 1. Use general fill.
 - 2. Fill up to subgrade elevation.
 - 3. Compact each lift to 90 percent of maximum dry density.
 - 4. Do not backfill against unsupported foundation walls.
 - 5. Backfill simultaneously on each side of unsupported foundation walls until supports are in place.
- E. Over Buried Utility Piping, Conduits, and Duct Bank in Trenches:
 - 1. Bedding: Use general fill.
 - 2. Cover with general fill.
 - 3. Fill up to subgrade elevation.
 - 4. Compact in maximum 8 inch (200 mm) lifts to 95 percent of maximum dry density.
- F. At Lawn Areas:
 - 1. Use general fill.
 - 2. Compact to 90 percent of maximum dry density.
 - 3. See Section 31 22 00 for topsoil placement.
- G. At Planting Areas Other Than Lawns:
 - 1. Use general fill.
 - 2. Compact to 90 percent of maximum dry density.
 - 3. See Section 31 22 00 for topsoil placement.
- H. Under Monolithic Paving:

1. Compact subsoil to 95 percent of its maximum dry density before placing fill.
2. Use general fill.
3. Fill up to subgrade elevation.
4. Compact to 95 percent of maximum dry density.
5. See Section 32 11 23 for aggregate base course placed over fill.

3.05 TOLERANCES

- A. Top Surface of General Filling: Plus or minus 1 inch (25 mm) from required elevations.
- B. Top Surface of Filling Under Paved Areas: Plus or minus 1/2 inch (12 mm) from required elevations.

3.06 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection and testing.
- B. Perform compaction density testing on compacted fill in accordance with ASTM D1556 or ASTM D6938.
 1. Field inspections and testing shall be performed and submitted in accordance with requirements specified in Section 01 40 00 - Quality Requirements.
- C. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 1557 ("modified Proctor") or AASHTO T 180.
- D. Laboratory Tests and Analyses: Where backfill is required to be compacted to a specified density, tests for compliance shall be made in accordance with requirements specified in Section 01 40 00 - Quality Requirements.
- E. Density Test Method: Density tests shall be in accordance with ASTM D1556 (Sand Cone Method) procedures. Allow testing service to inspect and approve each subgrade and fill layer before further fill, backfill or construction Work is performed.
- F. Alternate Density Test Method: Field density tests may also be performed by the nuclear method in accordance with ASTM D6938, providing that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D1556.
 1. In conjunction with each density calibration check, check the calibration curves furnished with the moisture gages in accordance with ASTM D6938.
 2. If field tests are performed using nuclear methods, make calibration checks of both density and moisture gages at beginning of Work, on each different type of material encountered, and at intervals as directed by Architect or Owner's testing and inspection agency.
- G. Non-compliance: If tests indicate work does not meet specified requirements, remove work, replace and retest.
- H. Should tests of fill or backfill indicate non-compliance with required density, Contractor shall over-excavate, recompact and retest until specified density is obtained.
 1. Costs and Time associated with remedial Work and retesting shall be in accordance with provisions of the General Conditions.
 - a. Retesting to demonstrate compliance shall be by a testing laboratory acceptable to Owner and shall be at Contractor's expense.

- I. Frequency of Tests:
 - 1. Footing Subgrade Testing: For each strata of soil on which footings will be placed, perform at least one test to verify required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested strata when acceptable to Geotechnical Engineer.
 - 2. Paved Areas and Building Slab Subgrade Testing:
 - a. Perform at least one field density test of subgrade for every 2,000 sf of paved area or building slab, but in no case fewer than three tests.
 - b. In each compacted fill layer, perform one field density test for every 2,000 sf of overlaying building slab or paved area, but in no case fewer than three tests.
- J. Proof roll compacted fill at surfaces that will be under slabs-on-grade.

3.07 CLEANING

- A. Leave unused materials in a neat, compact stockpile.
- B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.
- C. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION

SECTION 32 01 90 - 90-DAY ESTABLISHMENT PERIOD

PART 1 - GENERAL

1.3 RELATED DOCUMENTS

- A. The General Conditions of the contract apply to the work of this section the same as though written herein.

1.4 SCOPE OF WORK

- A. Furnish all labor, materials, and equipment to provide, and install, landscape drainage pipe, drain inlets and grates, tree pit drainage systems, and plant pit breather tubes as described herein and upon the drawings.
- B. The Contractor shall adequately protect the work, adjacent property, and the public, and shall be responsible for any damage, injury, and loss due to his acts or neglect. Contractor shall continuously protect and maintain all areas included in the contract during the progress of the work, through the establishment period, and until final acceptance of the work. Contractor is responsible for all repairs or replacements caused by acts of vandalism, including theft.
- C. The Contractor shall employ only Landscape Industry Certified Technicians (LICT's) with the California Landscape Contractors Association (CLCA), as foremen for all landscape maintenance work.
- D. Landscape maintenance of designated areas as specified herein. During and at the end of the maintenance period, all plant material shall be in a healthy, growing condition. Contractor shall provide all equipment, labor, all landscaped areas, turf sports fields, turf playfields, lawns, mulched areas, hydroseeded areas, slopes, tree wells, and other landscaped areas constructed as a part of this contract and materials necessary for performing landscape maintenance according to the following specifications.
- E. Complete landscape maintenance of entire site, including, but not limited to: pruning, shaping and training of trees, shrubs, and ground cover plants; fertilization; weed control, control of all plant diseases and insect pests; maintenance and repairs of irrigation and drainage systems; rodents; and all other maintenance required to maintain the landscaping in safe, attractive, and usable condition, and maintain all plant materiel in good condition with horticulturally acceptable growth and color.

1.5 RELATED SECTIONS

- A. 32 84 00 - Landscape Irrigation
- B. 32 91 13 - Soil Preparation
- C. 32 92 23 – Sodding

1.6 SUBMITTALS

- A. Submit samples and literature under provisions of Section 01 33 00 or Section 01 25 00 (or applicable Product Substitution section). Submit descriptive literature and specifications for the following:
 - 1. Any materials, which differ from that, specified, when a brand name is called for on the drawings or in these specifications.
- B. Contractor shall submit to the Landscape Architect within 30 days from notice to proceed photocopies of current Landscape Industry Certified Technician registration for all foremen performing work on this project.

1.7 QUALITY OF WORK

- A. All work shall be performed in accordance with the best landscape maintenance practices, and shall be in keeping with the high aesthetic level of the facilities being maintained.

1.8 DEFINITION

- A. Where “as directed”, “as required”, “as permitted”, “approved”, “acceptance”, or words of similar import are used, it shall be understood that the direction, requirement, permission, approval or acceptance of the Owner is intended unless otherwise stated. As used herein, “provide” shall be understood to mean “provide complete”, in place, that is “furnish and install”, the word “site” as used hereinafter shall be understood to mean the location receiving the service. The use of the word “Owner” shall be construed to mean Costco or its delegated representative(s). The use of the Word “Contractor” shall be held to mean the Contractor and/or any person employed by him and working under this contract. The use of the words “shall” and “may” shall be held to mean “mandatory” and “permissible”, respectively. The use of the word “pruning” shall include the practices sometimes referred to as “trimming”.

1.9 CONTRACTOR’S RESPONSIBILITIES

- A. Local Office: The contractor shall maintain a local office with a competent English-speaking company representative that can be reached during normal working hours and authorized to discuss matters pertaining to this contract with the Owner. A local office is one that can be reached by telephone without it being a toll call. An answering service or mobile telephone shall not fulfill the requirement for a local office.
- B. Licenses and Permits: The Contractor shall, prior to award of contract and without additional expense to the Owner, possess all licenses and permits required for the performance of the work required by this Contract, including C-27 Landscaping, C-61 Pest Control Advisor and Pest Control Operator, Tree Services, and applicable business license.

C. Personnel:

1. The Contractor shall furnish sufficient supervisory and working personnel capable of promptly accomplishing on schedule, to the satisfaction of the owner, all work required under this contract during the regular and prescribed hours.
2. The Contractor and his employees shall conduct themselves in a proper and efficient manner at all times and shall cause the least possible annoyance to the students, faculty, and the public. They shall be fully clothed in suitable uniformed attire.
3. The Contractor shall provide restroom facilities, i.e. (Porta John) at the maintenance yard for employee use.
4. Lunches are to be taken off-site or at the maintenance yard.
5. All contractor maintenance vehicles shall be marked with the company name and/or logo so as to identify personnel working on the job.
6. The Owner may require the Contractor to remove from the work site any employee(s) deemed careless, incompetent, or otherwise objectionable, whose continued employment on the job is considered to be contrary to the best interests of the Owner.
7. The Contractor shall have competent English speaking supervisor, who may be a working supervisor, on the job at all times work is being performed, who are capable of discussing with the Owner matters pertaining to this contract. Supervisor must have a minimum of three years of actual field experience in landscape maintenance exclusively, and must be able to demonstrate to the satisfaction of the Owner that they possess adequate technical background. Supervisor must possess a current Landscape Industry Certified Technician certificate in landscape maintenance. Adequate and competent supervision shall be provided for all work being done by the Contractor's employees to ensure accomplishment of high quality work which will be acceptable to the Owner. In addition, a non-working supervisor shall inspect all areas under the contract a minimum of two (2) times each week.

D. Repairs to Existing Facilities

1. All portions of buildings, structures, equipment or other facilities, including irrigation systems, lighting, and signage which are damaged or altered in any way, as a result of the performance of work under this specification during the terms of the contract, shall be repaired or replaced in kind and in an approved manner. All work of this kind shall be performed by the Contractor at no extra cost to the Owner and shall be accomplished as directed by the Owner. Repairs to facilities shall be made immediately after damage or alteration occurs, unless otherwise directed. A comprehensive testing and check of all irrigation systems shall be made approximately 30 days before the end of the contract and any repairs deemed the responsibility of the Contractor shall be made by the Contractor to the satisfaction of the Owner.
2. The Contractor shall keep controller and valve boxes clear of soil and debris and maintain the irrigation system including the replacement, repair, adjustment, raise or lower, straighten, and any other operations required for the continued proper operation of the system from the water meter throughout the site. Repair or replacement includes, but is not limited to: sprinkler system laterals (piping), sprinkler mains (pressure lines), mainline

sleeves, sprinkler control valves, sprinkler controllers, sprinkler heads, sprinkler caps, sprinkler head riser, valve covers, boxes and lids, including electrical pull boxes and lids, valve sleeves, quick coupler valves, hose bibs, and booster pumps.

3. The Owner shall be notified, within twenty-four (24) hours, of any damage caused by accident, vandalism, theft, acts of God, or mysterious causes and shall follow up notification within four (4) working days with a written description of the problem and steps taken, if any, to rectify the problems.
 4. Repairs to existing structures or facilities, including irrigation systems, which are damaged or altered in any way, including acts of God, vandalism, vehicular damage, theft or mysterious damages that do not result from the performance or lack of performance of the work by the Contractor, shall be repaired by the Contractor as directed by the Owner at no cost to the Contractor except where the specifications provide otherwise. Invoices for repairs to existing facilities shall be broken down by phases and units, into parkways, medians, slopes, entry monuments or recreation areas.
 5. Any replacement must conform to the type and kind of existing system. Any deviation must be submitted in writing for approval by the Owner prior to installation. Any materials installed without this approval, and subsequently rejected by the Owner, shall be promptly removed by the Contractor at no cost to the Owner.
- E. Safety Requirements: All work performed under this contract shall be performed in such a manner as to provide maximum safety to the public and where applicable, comply with all safety standards required by CAL-OSHA. The Owner reserves the right to issue restraint or cease and desist order to the Contractor when unsafe or harmful acts are observed or reported relative to the performance of the work under this contract.
- F. Hazardous Conditions: The Contractor shall maintain all work sites free of hazards to persons and or property resulting from his operations. Any hazardous condition noted by the Contractor, which is not a result of this operation, shall be immediately reported to the Owner.
- G. Use of Chemicals: The Contractor shall submit a list of all chemicals herbicides, rodenticides and pesticides proposed for use under this contract for approval by the Owner. Material included on this list shall be limited to chemicals approved by the State of California, Department of Agriculture, and shall include the exact brand name and generic foundation. The use of any chemicals on the list shall be based on the recommendations of a licensed pest control advisor. The use of chemicals shall conform to the current City of San Jose Department of Agriculture regulations. The Contractor shall notify the Owner in writing a minimum of four (4) working days prior to the application of any herbicide, rodenticide, or pesticide. Such notices shall include the purpose and area such chemicals are to be used. The Owner shall retain the option to disapprove the application of such chemicals before their application. The monthly report required in paragraph 1.5.2 in the General Conditions of these specifications, shall include a statement of all applications of herbicides, rodenticides, and pesticides detailing the chemical used, quantity, rate of application, area in which used and the purpose of the application. The uses of these chemicals shall be kept in an 8 1/2" x 11" ring notebook that shall be kept up to date and available for inspection by the Owner at all times.
- H. Litter

1. Contractor-Generated Trash: The Contractor shall promptly remove from the work area all debris generated by his performance of pruning, trimming, weeding, edging and other work required in the specifications. The Contractor shall clean, with suitable equipment, public streets and walks, driveways and paved areas immediately after working in the areas and at such other times as may be required by the Owner.
 2. Litter Pickup: All areas in the work site shall be kept free of, but not limited to the following items: bottles, glass, cans, paper, cardboard, metallic items and other debris. Litter pickup (litter removal from slope areas) shall be removed from the site and shall not be placed in "on-site" containers.
 3. Broken glass, a hazard, and other material or litter which may be hazard shall be picked up and removed from the site immediately by the Contractor.
 4. Seating areas, lunch courts, exercise areas, tunnel area, parking areas and other areas may on occasion be exceptionally littered and shall be cleared of litter before noon on the business day after the litter occurs.
- I. Failure to Perform Satisfactorily: Those discrepancies and deficiencies in the work that remain uncorrected may be the necessary justification for a billing adjustment in the month following in the occurrence. Billing adjustments for this unsatisfactory service shall be permanent retention of 100 percent of the estimated monthly cost for work that is incomplete or deficient as stated herein.
- J. Emergency Calls: The Contractor shall have the capability to receive and to respond immediately to calls of an emergency nature during normal working hours and during hours outside of normal working hours. Calls of an emergency nature received by the Owner shall be referred to the Contractor for immediate disposition.
- K. Monthly Walk-Throughs: The Contractor shall provide to the Owner a schedule of monthly walk- throughs. Any changes to this schedule shall be provided to the Owner at least two weeks prior to that meeting. Monthly maintenance walk-through to be performed with the Contractor and Owner's representative.

1.10 REPORTS / INSPECTIONS

- A. No special work shall be performed without first obtaining the written approval of the Owner.
- B. As part of the service, the Contractor shall submit a monthly "Landscape Report" to the Owner. This report shall outline the general condition of the landscape areas, any problem areas that have been found, recommendations on how the landscape should be improved and the status of projects pursuant to maintenance programs in progress.
- C. Once a month the Contractor shall accompany the Owner's Representative on a landscape inspection to review the status of maintenance, Landscape Report, and the landscape in general.

PART 2 - MATERIALS

2.1 ALL REPLACEMENT LANDSCAPE MATERIALS SHALL BE PER SECTION 32 92 23 OF THESE SPECIFICATIONS.

- 2.2 FERTILIZER SHALL BE PER SECTION 32 91 13.
- 2.3 REPLACEMENT PLANT MATERIALS SHALL BE PER SECTION 32 92 23.
- 2.4 PRE-EMERGENT HERBICIDES SHALL BE PER SECTION 32 93 00.
- 2.5 TOUCH-UP PAINT FOR SITE FURNISHINGS SUCH AS POTS, TRASH/RECYCLE CONTAINERS, BENCHES, EXERCISE EQUIPMENT AND THE LIKE SHALL BE FROM THE CORRESPONDING SITE FURNISHINGS MANUFACTURER/SUPPLIER.

PART 3 - EXECUTION

- 3.1 SCHEDULING OF WORK: The Contractor shall accomplish all normal landscape maintenance required under this contract between the hours of 7:00 a.m. and 8:00 p.m., Monday through Saturday. Exceptions may be made to normal working hours, where incidence of use may be too great during the hours specified to allow for proper maintenance. The Owner may grant, on an individual basis, permission to perform contract maintenance at other hours. No maintenance function that generates excess noise which would cause annoyance to residences in the area shall be commenced before 8:00 a.m... The Contractor shall establish a schedule of routine work to be followed in performance of this contract. This schedule shall include, but not be limited to turf mowing and edging days, dates of weeding, and dates for fertilizer application. This schedule shall be revised quarterly and a copy of this schedule shall be provided to the Owner prior to the performance of any work required by these specifications, and any changes in scheduling shall be reported, in writing, to the Owner immediately.

3.2 WORKFORCE

- A. For each area of maintenance responsibility, the contractor shall assign the following minimum work force of competent, experienced maintenance personnel full-time to this project.

Description	Personnel Assigned
General Site Trash Removal, Sweeping, Cleaning	0.5
Includes Irrigation System Maintenance and Repair	
<u>Fertilization/Plant Replacements/Pruning/Mowing</u>	<u>1.0</u>
Total personnel assigned full-time	1.5

- B. This work force shall be the minimum work force assigned to this period on a continuing day-to-day basis. If temporary conditions or emergency situations arise which prevent routine maintenance from being performed, according to the schedules and performance standards of these specifications, the Contractor shall assign additional personnel and crews on a temporary basis as required, to assure performance standards of this contract are continually being met. This includes the need to close off a lane when performing maintenance on parkways with the proper coning and significant notification to the City of San Diego. This shall be done at no additional cost to the Owner.
- C. As additional areas are added to and made part of the contract, the number of personnel assigned will be adjusted as required, to adequately maintain all landscaped areas according to the provisions and performance schedules and standards of these specifications. The Contractor shall conduct the work at all times in a manner which will not interfere with normal pedestrian

traffic on adjacent sidewalks or vehicular traffic on adjacent streets. In addition, a special schedule listing exact starting date for pesticide application, fertilization pruning and other infrequent operations, shall be furnished to the Owner on a yearly basis and any changes in scheduling shall be reported in writing, to the Owner immediately.

3.3 METHOD OF PERFORMING WORK

A. Irrigation System Maintenance & Repair

1. Follow water budgeting requirements shown on the irrigation plans.
2. Irrigation shall be done by the use of automatic sprinkler systems, where available and operable; however, failure of the existing irrigation system to provide full and proper coverage shall not relieve the Contractor of the responsibility to provide adequate irrigation with full and proper coverage to all areas in the work site.
3. Any damages to public or private property resulting from excessive irrigation water or irrigation water runoff shall be charged against the contract payment unless immediate repairs are made by the Contractor to the satisfaction of the Owner.
4. The Contractor shall periodically inspect the operation of the system for any malfunction. The Contractor shall maintain all sprinkler systems, in such a way as to guarantee proper coverage and full working capability and make whatever adjustments may be necessary to prevent excessive runoff into street right-of-way or other areas not meant to be irrigated.
5. This periodic inspection may occur more often, but not less frequently, than one inspection per week for turf areas and one inspection per two week period for slope areas.
6. Contractor will inspect the irrigation system for broken and clogged heads, malfunctioning or leaking valves, or any other condition which hamper the correct operation of the system.
7. Written notice must be given to the Owner a minimum of one week before proceeding with any work not covered by this contract. The Owner retains the option to disapprove the work at any time before it is started. All areas not adequately covered by a sprinkler system shall be irrigated by a portable irrigation method. The Contractor shall furnish all hoses, nozzles, sprinkler, etc., necessary to accomplish this supplementary irrigation. Care shall be exercised to prevent a waste of water, erosion and/or detrimental seepage into existing underground improvements or structures.
8. Controllers shall be programmed, where possible, to water between 9:00 p.m. and 6:00 a.m.
9. Contractor to repair/correct malfunctions of valves, sprinklers and irrigation lines and notify the Owner a minimum of 24 hours in advance of such repairs when at the Owner's expense. Notice will be followed by a written description of repairs/corrections made within four working days of completion of work.

B. Turf Grass

1. Edging: The lawns should be edged whenever necessary. The lawn edges shall be continuously maintained in a neat condition until final acceptance of the work.
2. Grass shall be mowed with sharp and adjusted mowers, sized appropriately for the size(s) of the area(s) being mowed. Mowing heights for various types of turfgrass are given in the table below:

Turfgrass Type	1st Mowing	2nd and Subsequent Mowings	Mower Type
Bermudagrass	1 -1/2 inches	1 inch	Flail or Reel
Cool Season Grass (Fescue, Ryegrass, Bluegrass)	2-1/2 inches	1-1/2 inches	Rotary

C. Fertilization

1. Notification: The Contractor shall inform the Owner at least forty eight (48) hours before beginning any fertilization and shall have previously submitted a schedule of application showing the site, date and approximate time to application of the fertilizer.
2. Rate and Time of Fertilization
 - a. Surface applications of additional fertilizer may be necessary initially or occasionally to encourage new plantings or nitrogen-starved ground cover. As part of the bi-monthly inspection of work the Owner may authorize the Contractor to have a soil analysis done in those areas that need greater attention. The method and areas for taking the soil samples and the laboratory doing the analysis along with recommendations and costs will be submitted to the Owner for approval before additional work is started. Contractor shall blow fertilizer off of paved areas such as tennis courts, pool decks, or any other recreation area.

D. Weed Control: All landscape areas within the specified maintenance areas shall be weeded a minimum of once every 30 days or as necessary and shall include all undesirable or misplaced plants.

1. Removal of all weeds by means of hand removal at regular two week intervals. Care shall be taken so as not to damage existing ground cover. Any Bermuda grass found within slope or shrub areas, should be eradicated immediately, and replanted with same ground cover in that area.

E. Disease Control

1. The Contractor shall regularly inspect all landscaped areas for presence of disease, insects or rodent infestation. The Contractor shall advise the Owner in writing within four (4) days

if disease, insect or rodent infestation is found; he shall identify the disease, insects or rodent and specify control measures to be taken. The Owner retains the option to disapprove the work before the work is started. The Contractor shall implement the approved control measures, exercising extreme caution in the application of all spray material, dusts, or other materials utilized.

2. Approved control measures shall be continued until the disease, insect or rodent is controlled to the satisfaction of the Owner. The Contractor shall utilize all safeguards necessary during disease, insect or rodent contract operations to ensure safety of the public and the employees of the Contractor.

F. Replacement of Plant Material

1. The Contractor shall notify the Owner in writing within four (4) days of the loss of plant material due to any cause.
2. The Contractor shall remove and replace any tree, shrub, turf or ground cover which is damaged or lost due to any cause. The Owner retains the option to disapprove the work before it is started and shall be responsible for replacement costs unless plant material is lost due to faulty maintenance or negligence. The size and species of replacement shrubs, turf or ground cover plants shall be as directed by the Owner. For replacement of trees see article.

G. The Contractor shall be responsible for maintaining free of weeds all sidewalks and paving.

3.4 OPERATION OF AUTOMATIC IRRIGATION CONTROLLERS

- A. Surrender all keys furnished promptly at the end of the contract period, or at anytime deemed necessary by the Owner.
- B. Protect the security of the Owner's property by keeping controller cabinets locked at all times.
- C. The Contractor shall verify that the weather-based controller is prohibiting operation on rainy weather and when suspension of irrigation is desirable to conserve while remaining within the guidelines of horticulturally-acceptable maintenance practices.
- D. Maintain the controller charts in place (within controller cabinet), and update when required.

3.5 MULCHING

- A. Replace shredded mulch and custom gravel rock mulch materials in mulched areas and shrub areas on a monthly basis, as needed, to maintain minimum thickness as specified in Section 32 93 00.

END OF SECTION 320190

SECTION 32 11 23
AGGREGATE BASE COURSES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aggregate base course.
- B. Paving aggregates.
- C. Soil sterilization.

1.02 RELATED REQUIREMENTS

- A. Section 31 22 00 - Grading: Preparation of site for base course.
- B. Section 31 23 16.13 - Trenching: Compacted fill over utility trenches under base course.
- C. Section 31 23 23 - Fill: Topsoil fill at areas adjacent to aggregate base course.
- D. Section 31 23 23 - Fill: Compacted fill under base course.
- E. Section 31 23 16.13 - Trenching: Compacted fill over utility trenches under base course.
- F. Section 32 12 16 - Asphalt Paving: Binder and finish asphalt courses.
- G. Section 32 13 13 - Concrete Paving: Finish concrete surface course.
- H. Section 32 17 13 - Parking Bumpers: Concrete bumpers.

1.03 REFERENCE STANDARDS

- A. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2007.
- B. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)); 2012.
- C. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.
- D. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2010.
- E. Standard Specifications for Public Works Construction, Riverside County, latest edition.
 - 1. Standard Specifications shall be as amended and adopted by authorities having jurisdiction, including the Riverside County.
 - 2. Where reference is made to Standard Details, such reference shall be to the Standard Details accompanying the Standard Specifications, as amended and adopted by the authorities having jurisdiction.
 - 3. Wherever term "Agency" occurs in Standard Specifications, it shall be understood to mean Owner for purposes of the Contract.
 - 4. Wherever term "Engineer" occurs in Standard Specifications, it shall be understood to mean Architect for purposes of the Contract.

1.04 SUBMITTALS

- A. Samples: 10 lb (4.5 kg) sample of each type of aggregate; submit in air-tight containers to testing laboratory.
- B. Materials Sources: Submit name of imported materials source.
- C. Certificates of Conformance: Aggregate and sterilant materials.
- D. Aggregate Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- E. Compaction Density Test Reports.

1.05 QUALITY ASSURANCE

- A. Regulatory Requirements: Where reference is made to Standard Specifications, the following shall apply.
 - 1. Perform off-site work in public rights-of-way in accordance with requirements of authorities having jurisdiction, including Standard Specifications for Public Works Construction, as amended and adopted by those authorities. For conditions not indicated otherwise on Contract Drawings, conform to Standard Details adopted by authorities having jurisdiction, including Standard Details for Public Works Construction, as amended and adopted by those authorities.
 - 2. Perform on-site Work as indicated and referenced on Contract Drawings and as specified herein.
- B. The quantity of volatile organic compounds (VOC) used in weed killer, tack coat, primer and other materials shall not exceed limits permitted under current regulations of:
 - 1. South Coast Air Quality Management District (AQMD).
- C. Source Quality Control: Obtain materials from one source throughout.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. When necessary, store materials on site in advance of need.
- B. Aggregate Storage, General:
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.
 - 3. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Sub-Base Material: Existing or imported materials as recommended in geotechnical report. Refer to Document 00 31 00 - Available Project Information.
- B. Aggregate: Coarse or crushed aggregate, conforming to County of Riverside Public Works Department standard.
 - 1. Green Book Standard Specifications 200-2.2.
- C. Coarse Aggregate: Angular crushed stone; free of shale, clay, friable material and debris.
 - 1. Graded in accordance with ASTM D2487 Group Symbol GW.

- D. Blended Aggregate: Pit run washed stone; free of shale, clay, friable material and debris.
 - 1. Graded in accordance with ASTM D2487 Group Symbol GW.
- E. Medium Aggregate: Natural stone, pea gravel; washed, free of clay, shale, organic matter.
 - 1. Grade in accordance with ASTM D2487 Group Symbol GM.
- F. Fine Aggregate: Sand; conforming to County of Riverside Public Works Department standard.
- G. Herbicide: Comply with all applicable environmental protection and hazardous materials laws and regulations.
 - 1. Monobor-Chlorate non-selective weed and grass killer, by J.R. Simplot Co., Lathrop, CA;
 - 2. Poly-Bor Chlorate or Mono-Bor-Chlorate by United States Borax;
 - 3. Monobar-Chlorate by Occidental Chemical;
 - 4. Casoron 50W by Uniroyal Chemical Co., Inc.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- H. Geotextile Fabric: Non-biodegradable, non-woven.

2.02 SOURCE QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for testing and analysis of aggregate materials.
- B. Where aggregate materials are specified using ASTM D2487 classification, testing of samples for compliance shall be provided before delivery to site.
- C. If tests indicate materials do not meet specified requirements, change material and retest.
- D. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey bench marks and intended elevations for the work are as indicated.
- B. Verify substrate has been inspected, gradients and elevations are correct, and is dry.

3.02 PREPARATION

- A. Stockpiling:
 - 1. Clear and level storage sites prior to stockpiling of material.
 - 2. Stockpile all materials, including approved material available from excavation and grading, in the manner and at the locations designated.
 - 3. Aggregates shall be stockpiled on the cleared and leveled areas designated by the Construction Manager to prevent segregation.
 - 4. Materials obtained from different sources shall be stockpiled separately.
- B. Soil Sterilant: Sterilize soil areas to receive paving. Apply soil sterilant in accordance with manufacturer's instructions and applicable environmental regulations. Take care to confine application to the areas to be paved.
- C. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.

- D. Do not place aggregate on soft, muddy, or frozen surfaces.

3.03 INSTALLATION

- A. Place and compact aggregate base material in accordance with Standard Specifications, Subsection 301-2. Place aggregate base below curbs and gutters and paving also, compacted to 95 percent at vehicular traffic and 90 percent at pedestrian-only traffic.
- B. Under Bituminous Concrete Paving:
 - 1. Compact to 95 percent of maximum dry density and 90 percent at pedestrian-only traffic.
- C. Under Portland Cement Concrete Paving:
 - 1. Compact to 95 percent of maximum dry density and 90 percent at pedestrian-only traffic.
- D. Place aggregate in maximum 4 inch (100 mm) layers and roller compact to specified density.
- E. Level and contour surfaces to elevations and gradients indicated.
- F. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.
- G. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.
- H. Use mechanical tamping equipment in areas inaccessible to compaction equipment.
- I. Apply herbicide to finished surface.

3.04 TOLERANCES

- A. Flatness: Maximum variation of 1/4 inch (6.4 mm) measured with 10 foot (3 m) straight edge.
- B. Scheduled compacted thickness: Within 1/4 inch (6.4 mm).
- C. Variation from design elevation: Within 1/2 inch (12.8 mm).

3.05 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection and testing.
- B. Compaction density testing shall be performed on compacted aggregate base course in accordance with ASTM D1556 or ASTM D6938.
- C. Results will be evaluated in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D1557 ("modified Proctor").
- D. If tests indicate work does not meet specified requirements, remove work, replace and retest.
- E. Proof roll compacted aggregate at surfaces that are under slabs-on-grade and paving.

3.06 CLEANING

- A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.
- B. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION

SECTION 321216 ASPHALT PAVING

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. Cold milling of existing asphalt pavement.
 - 2. Hot-mix asphalt patching.
 - 3. Hot-mix asphalt paving.
 - 4. Hot-mix asphalt overlay.
 - 5. Asphalt curbs.
 - 6. Asphalt traffic-calming devices.
 - 7. Asphalt surface treatments.
 - a. Seal Coats.
 - b. Crack Sealants.
- B. Related Requirements:
 - 1. Section 02 41 19 "Selective Demolition" for demolition and removal of existing asphalt pavement.
 - 2. Section 31 20 00 "Earth Moving" for subgrade preparation, fill material, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.
 - 3. Section 32 13 73 "Concrete Paving Joint Sealants" for joint sealants and fillers at pavement terminations.
 - 4. Section 32 14 00 "Unit Paving" for bituminous setting bed for pavers.
 - 5. Section 32 17 13 "Parking Bumpers" for wheel stops.
 - 6. Section 32 17 23 "Pavement Markings" for striping and signage on the pavement.

1.3 SYSTEM DESCRIPTION

- A. Provide hot-mix asphalt pavement according to the materials, workmanship, and other applicable requirements of the standard specifications of the State.
 - 1. Standard Specification: CalTrans.
 - 2. Manual of Tests: CalTrans.
 - 3. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.4 PRE-INSTALLATION MEETINGS

- A. Pre-installation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:
 - a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
 - b. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include technical data and tested physical and performance properties.
 - 2. Job-Mix Designs: For each job mix proposed for the Work.
- B. Samples for Verification: For the following product, in manufacturer's standard sizes unless otherwise indicated:
 - 1. Paving Fabric: 12 by 12 inches minimum.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For each manufacturer.
- B. Material Certificates: For each paving material. Submit certificate for each paving material, signed by manufacturer certifying that each material complies with requirements. Include statement that mixes containing recycled materials will perform equal to mixes produced from all new materials.
- C. Material Test Reports: For each paving material, by a qualified testing agency.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by the California Department of Transportation (CalTrans).
- B. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of the California Department of Transportation (CalTrans) for asphalt paving work.
 - 1. Comply with requirements of local jurisdictions where more stringent than CalTrans requirements.
 - 2. Measurement and payment provisions and safety program submittals included in CalTrans standard specifications do not apply to this Section.
 - 3. Comply with the applicable standards of the San Diego County Air Pollution Control District for quantities of volatile organic compounds (VOC's) used in all materials.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
- B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
 - 1. Prime Coat: Minimum surface temperature of 60 deg F.
 - 2. Tack Coat: Minimum surface temperature of 60 deg F.
 - 3. Slurry Coat: Comply with weather limitations in ASTM D 3910.
 - 4. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
 - 5. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

PART 2 - PRODUCTS

2.1 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations.
- B. Base Coarse Aggregate: Class 2 Aggregate Base mineral aggregate, 3/4 inch maximum size, as specified in CalTrans Standard Specifications.
 - 1. Recycled asphalt paving may be used as base course aggregate, subject to complying with CalTrans Standard Specifications.
- C. Asphalt Aggregate: Type B Aggregate, as specified in CalTrans Standard Specifications.
 - 1. 3/4 inch maximum size for base course.
 - 2. 1/2 inch maximum size for surface course.
 - 3. 1/4 inch maximum size for surface course for playgrounds and similar areas.

2.2 ASPHALT MATERIALS

- A. Asphalt Binder: AASHTO M 320.
- B. Asphalt Cement: Steam Refined, penetration-graded material. AR-8000 or AR-4000 conforming to CalTrans Standard Specifications.
- C. Tack Coat: ASTM D 977 emulsified asphalt, or ASTM D 2397 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.
- D. Seal Coat: Emulsified asphalt with a minimum 2 percent to 3 percent latex or copolymer added with 2 to 4 lbs of grade #30 silica sand added per gallon and mechanically agitated.
- E. Water: Potable.

2.3 AUXILIARY MATERIALS

- A. Recycled Materials for Hot-Mix Asphalt Mixes: Reclaimed asphalt pavement from sources and gradations that have performed satisfactorily in previous installations, equal to performance of required hot-mix asphalt paving produced from all new materials.
- B. Herbicide: Commercial chemical for weed control, registered by the Environmental Protection Agency (EPA), and not classified as "restricted use" for locations and conditions of application. Provide in granular, liquid, or wettable powder form.
- C. Sand: ASTM D 1073 or AASHTO M 29, Grade No. 2 or No. 3.
- D. Paving Geotextile: AASHTO M 288 paving fabric; nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.
- E. Crack Sealer: Rubberized joint sealant complying with Federal Standards ASTM D 5329 Parking Lot Crack Sealer.

2.4 MIXES

- A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes; designed according to procedures in AI MS-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types"; and complying with the following requirements:
 - 1. Comply with CalTrans Standard Specifications.

2. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
- B. Base Course: Comply with CalTrans Standard Specifications.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Ensure that any air handling system that is likely to ingest fumes is protected and that windows near paving operations are closed.
- B. Verify that subgrade is dry and in suitable condition to begin paving.
- C. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
 2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Geotechnical Testing Agency, and replace with compacted backfill or fill as directed.
- D. Notify District Construction Manager in writing of any unsatisfactory conditions. Proceed with paving only after unsatisfactory conditions have been corrected.
- E. Verify that utilities, traffic loop detectors, and other items requiring a cut and installation beneath the asphalt surface have been completed and that asphalt surface has been repaired flush with adjacent asphalt prior to beginning installation of imprinted asphalt.

3.2 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
 1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.
- B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
- C. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.
 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.3 PAVING GEOTEXTILE INSTALLATION

- A. Apply asphalt binder / cement, consisting of solvent-free emulsified asphalt, uniformly to existing pavement surfaces at a rate of 0.20 to 0.30 gal./sq. yd.
- B. Place paving geotextile promptly according to manufacturer's written instructions. Broom or roll geotextile smooth and free of wrinkles and folds. Overlap longitudinal joints 4 inches and transverse joints 6 inches.

- C. Protect paving geotextile from traffic and other damage, and place hot-mix asphalt overlay the same day.

3.4 PLACING BASE COURSE

- A. Install paving geotextile on prepared subgrade or subbase according to manufacturer's written instructions, overlapping sides and ends.
- B. Place base course as follows:
 - 1. Compact base courses at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.
 - 2. Shape base to required crown elevations and cross-slope grades.
 - 3. When thickness of compacted base course is 6 inches or less, place materials in a single layer.
 - 4. When thickness of compacted base course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches or less than 3 inches thick when compacted.

3.5 PLACING HOT-MIX ASPHALT

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 - 1. When thickness of asphalt course is 4 inches or less, place materials in a single layer.
 - 2. When thickness of asphalt course exceeds 4 inches, place material in equal layers, with no layer more than 4 inches or less than 2 inches thick when compacted.
 - 3. Spread mix at a minimum temperature of 250 deg F.
 - 4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
 - 5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
 - 1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches from strip to strip to ensure proper compaction of mix along longitudinal joints.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.6 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
 - 1. Clean contact surfaces and apply tack coat to joints.
 - 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
 - 3. Offset transverse joints, in successive courses, a minimum of 24 inches.
 - 4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered"

method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."

5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.7 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
 1. Complete compaction before mix temperature cools to 185 deg F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Use a vibratory roller with dynamic force of 93,000 lbs, or weighing 21,000 lbs. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Repair surfaces by loosening displaced material, filling with hot-mix asphalt, and rerolling to required elevations. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
 1. Average Density (Marshall Test Method): 96 percent of reference laboratory density according to ASTM D 6927 or AASHTO T 245, but not less than 94 percent or greater than 100 percent.
 2. Average Density (Rice Test Method): 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.8 ASPHALT CURBS

- A. Construct hot-mix asphalt curbs over compacted pavement surfaces. Apply a light tack coat unless pavement surface is still tacky and free from dust. Spread mix at a minimum temperature of 250 deg F.
 1. Asphalt Mix: Same as pavement surface-course mix.

- B. Place hot-mix asphalt to curb cross section indicated or, if not indicated, to local standard shapes, by machine or by hand in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms after hot-mix asphalt has cooled.

C.

3.9 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 - 1. Base Course: Plus or minus 1/2 inch.
 - 2. Surface Course: Plus 1/4 inch, no minus.
- B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
 - 1. Base Course: 1/4 inch.
 - 2. Surface Course: 1/8 inch.
 - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.
- C. Asphalt Speed Bumps: Compact and form asphalt to produce the contour indicated and within a tolerance of plus or minus 1/8 inch of height indicated above pavement surface.

3.10 CRACK REPAIR

- A. Remove vegetation and treat with herbicide.
- B. Rout cracks in accordance with SHRP H348 and H349.
- C. Fill cracks with hot-applied joint sealant. Apply with a wand from a double jacketed melter.
 - 1. Over-fill cracks and squeegee level with pavement
 - 2.

3.11 FIELD QUALITY CONTROL

- A. Testing Agency: District will engage a qualified testing agency to perform tests and inspections and to prepare test reports.
- B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
- C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- D. Replace and compact hot-mix asphalt where core tests were taken.
- E. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.12 WASTE HANDLING

- A. General: Handle asphalt-paving waste according to approved waste management plan required in Section 01 74 19 "Construction Waste Management and Disposal."
- B. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow milled materials to accumulate on-site.

END OF SECTION 321216

SECTION 321313 - CONCRETE PAVING

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 Concrete Paving Including the Following:
 - 1. Driveways.
 - 2. Roadways.
 - 3. Parking lots.
 - 4. Curbs and gutters.
 - 5. Walks.
- B. Related Requirements:
 - 1. Section 033000 "Cast-in-Place Concrete" for general building applications of concrete.
 - 2. Section 321373 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.
 - 3. Section 321713 "Parking Bumpers."
 - 4. Section 321723 "Pavement Markings."
 - 5. Section 321726 "Tactile Warning Surfacing" for detectable warning tiles.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to concrete paving, including but not limited to, the following:
 - a. Concrete mixture design.
 - b. Quality control of concrete materials and concrete paving construction practices.
 - 2. Require representatives of each entity directly concerned with concrete paving 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 paving Subcontractor.
 - e. Manufacturer's representative of stamped concrete paving system used for stamped detectable warnings.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
 3. Laboratory Test Reports: For concrete paving mixtures, documentation indicating that cured concrete complies with Solar Reflectance Index requirements.
- C. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color selection.
- D. Samples for Verification: For each type of product or exposed finish, prepared as Samples of size indicated below:
1. Exposed Aggregate: 10-lb Sample of each mix.
 2. Colored Concrete: 3" x 3" samples. Provide two samples of each color
- E. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Material Certificates: For the following, from manufacturer:
1. Cementitious materials.
 2. Steel reinforcement and reinforcement accessories.
 3. Fiber reinforcement.
 4. Admixtures.
 5. Curing compounds.
 6. Applied finish materials.
 7. Bonding agent or epoxy adhesive.
 8. Joint fillers.
- C. Material Test Reports: For each of the following:
1. Aggregates: Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.
- D. Field quality-control reports.

1.7 QUALITY ASSURANCE

- A. Stamped Detectable Warning Installer Qualifications: An employer of workers trained and approved by manufacturer of stamped concrete paving systems.
- B. Ready-Mix-Concrete 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" (Quality Control Manual - Section 3, "Plant Certification Checklist").
- C. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
 - D. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 1. Build mockups of full-thickness sections of concrete paving to demonstrate typical joints; surface finish, texture, and color; curing; and standard of workmanship.
 2. Build mockups of concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Architect and not less than 96 inches **by** 96 inches
 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.
 - E. Portland Cement Concrete paving shall be stable, firm, and slip resistant and shall comply with CBC Sections 11B-302 and 11B-403
- 1.8 PRECONSTRUCTION TESTING
- A. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on concrete paving mixtures.
- 1.9 FIELD CONDITIONS
- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.
 - B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:
 1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
 2. Do not use frozen materials or materials containing ice or snow.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.
 - C. Hot-Weather Concrete Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
 1. Cool ingredients before mixing to 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 in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with ACI 301 unless otherwise indicated.

2.2 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
 - 1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, fabricated from as-drawn steel wire into flat sheets.
- C. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.
- D. Epoxy-Coated Welded-Wire Reinforcement: ASTM A 884/A 884M, Class A, plain steel.
- E. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 ; deformed.
- F. Galvanized Reinforcing Bars: ASTM A 767/A 767M, Class II zinc coated, hot-dip galvanized after fabrication and bending; with ASTM A 615/A 615M, Grade 60 deformed bars.
- G. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M or ASTM A 934/A 934M; with ASTM A 615/A 615M, Grade 60 deformed bars.
- H. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60 deformed bars; assembled with clips.
- I. Plain-Steel Wire: ASTM A 1064/A 1064M, as drawn.
- J. Deformed-Steel Wire: ASTM A 1064/A 1064M.
- K. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A; coated, plain.
- L. 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.
- M. Epoxy-Coated, Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60 plain-steel bars.
- N. Tie Bars: ASTM A 615/A 615M, Grade 60 ; deformed.
- O. Hook Bolts: ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

- P. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:
 - 1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
 - 2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
- Q. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.
- R. Zinc Repair Material: ASTM A 780/A 780M.

2.4 CONCRETE MATERIALS

- A. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:
 - 1. Portland Cement: ASTM C 150/C 150M, gray portland cement Type V.
 - 2. Fly Ash: ASTM C 618, Class C or Class F.
- B. Normal-Weight Aggregates: ASTM C 33/C 33M, , uniformly graded. Provide aggregates from a single source.
 - 1. Maximum Coarse-Aggregate Size: 1 inch nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Exposed Aggregate: Selected, hard, and durable; washed; free of materials with deleterious reactivity to cement or that cause staining; from a single source, with gap-graded coarse aggregate as follows:
 - 1. Aggregate Sizes: 1/2 to 3/4 inch nominal.
- D. Air-Entraining Admixture: ASTM C 260/C 260M.
- E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 3. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
- F. Color Pigment: ASTM C 979/C 979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following
 - a. Davis Colors.
 - b. Scofield, L. M. Company.
 - c. .
 - d. SureCrete Design Products.
 - e. Or equal
 - 2. Color:
 - a. Paving Type A: Natural gray with broom finish.
 - b. Paving Type B: Integral color with 100 percent aggregate coverage.
 - 1) Color: Davis "Rustic Brown" #6058 admixture.
 - 2) Finish per 3.6G

- c. Paving Type C: Integral color with stamped.
 - 1) Color: Davis "Graphite" #8084 admixture.
 - 2) Finish per 3.6H
- d. Paving Type D: Integral color with medium etched finish.
 - 1) Color: Davis "Taupe" #677 admixture
 - 2) Finish per 3.6H
- G. Water: Potable and complying with ASTM C 94/C 94M.

2.5 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.
 - 1. Products: Subject to compliance with requirements, provide the following
 - a. ChemMasters, Inc; Spray-Film.
 - b. Dayton Superior; AquaFilm Concentrate J74.
 - c. Euclid Chemical Company (The); an RPM company; Eucobar.
 - d. Kaufman Products, Inc; VaporAid.
 - e. L&M Construction Chemicals, Inc; E-CON.
 - f. Sika Corporation; SikaFilm.
 - g. Or equal
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
 - 1. Products: Subject to compliance with requirements, [provide one of the following
 - a. ChemMasters, Inc; Safe-Cure Clear DR.
 - b. Dayton Superior; Clear Resin Cure J11W.
 - c. Euclid Chemical Company (The); an RPM company;
 - d. Kaufman Products, Inc; DR Cure.
 - e. L&M Construction Chemicals, Inc; L&M CURE R.
 - f. Or equal.

2.6 RELATED MATERIALS

- A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber in preformed strips.
- B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.
- C. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy-Bonding Adhesive: ASTM C 881/C 881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- E. Chemical Surface Retarder: Water-soluble, liquid, set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch .
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ChemMasters, Inc; Exposee.
 - b. Dayton Superior; Top-Cast.
 - c. Euclid Chemical Company (The); an RPM company; Surface Retarder Formula S.
 - d. Kaufman Products, Inc; Expose.
 - e. Scofield, L. M. Company; LITHOTEX Top Surface Retarder.
 - f. Sika Corporation; Rugasol-S.
 - g. Or equal .

2.7 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301 , for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
 1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
 2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that comply with or exceed requirements.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 1. Fly Ash or Pozzolan: 25 percent.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
 1. Air Content: [~~5-1/2~~] [~~4-1/2~~] [~~2-1/2~~] percent plus or minus 1-1/2 percent for 1-1/2-inch nominal maximum aggregate size.
 2. Air Content: [~~6~~] [~~4-1/2~~] [~~3~~] percent plus or minus 1-1/2 percent for 1-inch nominal maximum aggregate size.
 3. Air Content: **5**percent plus or minus 1-1/2 percent for 3/4-inch nominal maximum aggregate size.
- D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
 1. Use high-range, water-reducing and retarding admixture in concrete as required for placement and workability.
 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
- F. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.
- G. Concrete Mixtures: Normal-weight concrete.
 1. Compressive Strength (28 Days): 3000 psi .
 2. Maximum W/C Ratio at Point of Placement: **0.50**.
 3. Slump Limit: 4 inches , plus or minus 1 inch .

4. Solar Reflectance Index: Not less than 29.

2.8 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M. Furnish batch certificates for each batch discharged and used in the Work.
 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
 1. For concrete batches of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
 2. For concrete batches larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proof-roll prepared subbase surface below **concrete paving** to identify soft pockets and areas of excess yielding.
 1. Completely proof-roll subbase in one direction. Limit vehicle speed to 3 mph .
 2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons .
 3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 312000 "Earth Moving."
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- E. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.
- F. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.5 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
 - 1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
 - 1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
 - 2. Provide tie bars at sides of paving strips where indicated.
 - 3. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
 - 1. Locate expansion joints at intervals of 50 feet unless otherwise indicated.
 - 2. Extend joint fillers full width and depth of joint.
 - 3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
 - 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
 - 5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 - 6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a [1/4-inch] [3/8-inch] radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.
- B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.
- F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
 - 1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement dowels and joint devices.
- H. Screed paving surface with a straightedge and strike off.
- I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.
- K. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.
 - 1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

3.7 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
 - 1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
 - 2. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.

3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.8 SPECIAL FINISHES

- A. Monolithic Exposed-Aggregate Finish: Expose coarse aggregate in paving surface as follows:
 1. Immediately after float finishing, spray-apply chemical surface retarder to paving according to manufacturer's written instructions.
 2. Cover paving surface with plastic sheeting, sealing laps with tape, and remove when ready to continue finishing operations.
 3. Without dislodging aggregate, remove mortar concealing the aggregate by lightly brushing surface with a stiff, nylon-bristle broom. Do not expose more than one-third of the average diameter of the aggregate and not more than one-half of the diameter of the smallest aggregate.
 4. Fine-spray surface with water and brush. Repeat cycle of water flushing and brushing until cement film is removed from aggregate surfaces to depth required.
- B. Seeded Exposed-Aggregate Finish: Immediately after initial floating, spread a single layer of aggregate uniformly on paving surface. Tamp aggregate into plastic concrete and float finish to entirely embed aggregate with mortar cover of 1/16 inch .
 1. Spray-apply chemical surface retarder to paving according to manufacturer's written instructions.
 2. Cover paving surface with plastic sheeting, sealing laps with tape, and remove sheeting when ready to continue finishing operations.
 3. Without dislodging aggregate, remove mortar concealing the aggregate by lightly brushing surface with a stiff, nylon-bristle broom. Do not expose more than one-third of the average diameter of the aggregate and not more than one-half of the diameter of the smallest aggregate.
 4. Fine-spray surface with water and brush. Repeat cycle of water flushing and brushing until cement film is removed from aggregate surfaces to depth required.
- C. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on paving surface according to manufacturer's written instructions and as follows:
 1. Uniformly spread 25 lb/100 sq. ft. of dampened, slip-resistive aggregate over paving surface in two applications. Tamp aggregate flush with surface using a steel trowel, but do not force below surface.
 2. Uniformly distribute approximately two-thirds of slip-resistive aggregate over paving surface with mechanical spreader, allow to absorb moisture, and embed by power floating. Follow power floating with a second slip-resistive aggregate application, uniformly distributing remainder of material at right angles to first application to ensure uniform coverage, and embed by power floating.
 3. Cure concrete with curing compound recommended by slip-resistive aggregate manufacturer. Apply curing compound immediately after final finishing.
 4. After curing, lightly work surface with a steel-wire brush or abrasive stone and water to expose nonslip aggregate.
- D. Pigmented Mineral Dry-Shake Hardener Finish: After initial floating, apply dry-shake materials to paving surface according to manufacturer's written instructions and as follows:
 1. Uniformly spread dry-shake hardener at a rate of 100 lb/100 sq. ft. unless greater amount is recommended by manufacturer to match paving color required.

2. Uniformly distribute approximately two-thirds of dry-shake hardener over the concrete surface with mechanical spreader; allow hardener to absorb moisture and embed it by power floating. Follow power floating with a second application of pigmented mineral dry-shake hardener, uniformly distributing remainder of material at right angles to first application to ensure uniform color, and embed hardener by final power floating.
3. After final power floating, apply a hand-troweled finish followed by a broom finish.
4. Cure concrete with curing compound recommended by dry-shake hardener manufacturer. Apply curing compound immediately after final finishing.

3.9 DETECTABLE WARNING INSTALLATION

- A. Blockouts: Form blockouts in concrete for installation of detectable paving units specified in Section 321726 "Tactile Warning Surfacing."
 1. Tolerance for Opening Size: Plus 1/4 inch , no minus.
- B. Cast-in-Place Detectable Warning Tiles: Form blockouts in concrete for installation of tiles specified in Section 321726 "Tactile Warning Surfacing." Screed surface of concrete where tiles are to be installed to elevation, so that edges of installed tiles will be flush with surrounding concrete paving. Embed tiles in fresh concrete to comply with Section 321726 "Tactile Warning Surfacing" immediately after screeding concrete surface.
 - 1.

3.10 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by **moisture-retaining-cover curing curing compound** follows:
 1. Moisture Curing: 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, placed in widest practicable width, with sides and ends lapped at least 12 inches , and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period, using cover material and waterproof tape.
 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.

3.11 PAVING TOLERANCES

- A. Comply with tolerances in ACI 117 and as follows:
 - 1. Elevation: 3/4 inch .
 - 2. Thickness: Plus 3/8 inch , minus 1/4 inch .
 - 3. Surface: Gap below 10-feet- long; unlevelled straightedge not to exceed 1/2 inch .
 - 4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
 - 5. Lateral Alignment and Spacing of Dowels: 1 inch .
 - 6. Vertical Alignment of Dowels: 1/4 inch .
 - 7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
 - 8. Joint Spacing: 3 inches .
 - 9. Contraction Joint Depth: Plus 1/4 inch , no minus.
 - 10. Joint Width: Plus 1/8 inch , no minus.

3.12 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain at least one composite sample for each 5000 sq. ft. or fraction thereof of each concrete mixture placed each day.
 - 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/C 231M, pressure method; 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 it is 80 deg F and above, and one test for each composite sample.
 - 5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
 - 6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.
- C. Strength of each concrete mixture will be satisfactory if 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 .
- D. Test results shall be reported in writing to Architect, concrete manufacturer, 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.

- E. 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.
- F. 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.
- G. Concrete paving will be considered defective if it does not pass tests and inspections.
- H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- I. Prepare test and inspection reports.

3.13 REPAIR AND PROTECTION

- A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.
- B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.
- C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION **321313**

SECTION 321373 – CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Expansion and contraction joints within portland cement concrete pavement.

1.3 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Product Certificates: Signed by manufacturers of joint sealants certifying that products furnished comply with requirements and are suitable for the use indicated.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: 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.
 - 2. When joint substrates are wet.
- B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than that allowed by joint sealant manufacturer for application indicated.
- C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backing materials, 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 testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range for this characteristic.

2.2 COLD-APPLIED JOINT SEALANTS

- A. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, non-sag silicone sealant complying with ASTM D 5893 for Type NS.
- B. Products: Subject to compliance with requirements, provide the following:
 - 1. Type NS Silicone Sealant for Concrete:
 - a. Roadsaver Silicone-SL; Crafco Inc.
 - b. 888; Dow Corning.
 - c. Pecora Corporation; 300SL.

2.3 JOINT-SEALANT BACKER MATERIALS

- A. General: Provide joint-sealant backer materials that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint sealant manufacturer based on field experience and laboratory testing.
- B. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depths and prevent bottom-side adhesion of sealant.

2.4 PRIMERS

- A. Primers: Product recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint- sealant-substrate tests and field tests.

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.
- B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant manufacturer's written installation instructions applicable to products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

- C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of backer materials.
 - 2. Do not stretch, twist, puncture, or tear backer materials.
 - 3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.
 - D. Install sealants by proven techniques to 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 provided for each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
 - E. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealants from surfaces adjacent to joint.
 - 2. Use tooling agents that are approved in writing by joint sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - F. Provide joint configuration to comply with joint sealant manufacturer's written instructions, unless otherwise indicated.
- 3.4 CLEANING
- A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.
- 3.5 PROTECTION
- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

END OF SECTION **321373**

SECTION 321540 - STABILIZED DECOMPOSED GRANITE SURFACING

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. Stabilized aggregate decomposed granite (DG) paving Related Requirements.
 - 1. Section 312000 "Earth Moving" for subgrade preparation.

1.3 SUBMITTALS

- A. Products and Data:
 - 1. Conform to procedures and quantities as specified under Section 013300.
 - 2. For base course, if required, submit material Certification and Analysis Report.
 - 3. Decomposed Granite: Provide packaged sample equal to one half (1/2) pound of decomposed granite or crushed 3/8" minus or 1/4" minus for strength and color, include source of material with telephone number and address.
 - 4. Aggregate Binder: Provide packaged samples equal to one half (1/2) pound, include source of material with telephone number and address as well as manufacture's instructions for mixing and application.

1.4 PROJECT/SITE CONDITIONS

- A. Field Measurements: Each bidder is required to visit the site of the Work to verify the existing conditions. No adjustments will be made to the Contract Sum for variations in the existing conditions.
 - 1. Where surfacing is indicated to fit with other construction, verify dimensions of other construction by field measurements before proceeding with the work.
- B. Environmental Limitations: Do not install decomposed granite or crushed 3/8" or 1/4" minus aggregate paving during rainy conditions or below 40 degrees Fahrenheit and falling.

1.5 PERFORMANCE REQUIREMENTS

- A. Perform gradation of decomposed granite material or 3/8" minus or 1/4" minus crusher fines aggregate in accordance with ASTM C 136 – Method for Sieve Analysis for Fine and Course.
- B. Standard Specifications for Public Works Construction, 2000 Edition including Regional Supplements Amendments. Add Special Requirements by City or County.

1.6 QUALITY ASSURANCE

- A. A. Installer Qualifications: Installer to provide evidence to indicate successful experience in providing stabilized decomposed granite or crusher fines 3/8" minus or 1/4" minus aggregate paving.

1.7 FIELD MOCK-UP

- A. Construct at earliest possible time and at approved location before proceeding with the work.

- B. Prepare one (1) 10 feet by width of path, paving mock-up, complete with base coarse-if required, edging, and compacted as specified. Include adjustments, approved by the Owner's Representative from reviews of the mock-up process. Coordinate work with conditions and material placement of other work and adjacent conditions.
- C. The Mock-up shall be reviewed and approved by the Owner's Representative prior to proceeding with the work. When necessary, remove and reconstruct the field sample until approved. Approved mock-up shall serve as the standard of acceptance for the paving work.
- D. The approved mock-up may be incorporated into the final work. Demolish and remove nonapproved mock-ups.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Bulk Material: Comply with Section 01600 for delivery and storage requirements.
- B. Do not expose materials to excessive moisture or other conditions that would adversely affect their serviceability.

1.9 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Special Warranty: Submit a written warranty executed by the installer agreeing to repair or replace components of stabilized surfacing that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:
 - 1. Premature wear and tear provided the material is maintained in accordance with manufacturer's written maintenance instructions.
 - 2. Failure of system to meet performance requirements.
- C. Warranty Period: Contractor shall provide warranty for performance of product. Contractor shall warranty installation of product for the time of one year from completion.
- D. Contractor shall provide, for a period of sixty days, unconditional maintenance and repairs as required.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Binder: Organic, non-toxic, non-staining, odorless, environmentally safe powder which binds decomposed granite, crusher fines 3/8" minus or 1/4" minus aggregate.
- B. Decomposed Granite: Crushed aggregate fines color shall be "New California Gold" and size shall be 3/8" minus unless otherwise specified on the Drawings. Material available at KRC Rock (800-572-7625). Material shall consist of inert materials that are hard and durable, with stone free from surface coatings and deleterious materials. Gradation recommendations shall be as follows unless otherwise specified.

U.S. Sieve No.	Percent Passing by Weight
# 1/2"	95 – 100
# 3/8"	90 – 100

# 4	65 – 80
# 8	48 – 63
# 16	40 – 49
# 30	30 – 40
# 50	20 – 27
# 100	10 – 18

- C. Sand: Equivalent shall be in the range of 35-55. The R-value shall be a minimum of 71. ASTM testing shall be used for the sand equivalent and R-value determination.
- D. Decomposed Granite and Binder Compound: Decomposed Granite or 3/8" minus or 1/4" minus crushed aggregate screenings will be supplied to Contractor from a single source in a preblended ratio of 12 lbs of soil binding agent per 1-ton of Decomposed Granite. E. Water, clean potable.
- E. Imported Base Material: Class 2 base Crushed aggregate base consisting entirely of crushed rock and rock dust, uniformly graded and conforming to the requirements of Standard Specifications Section 200-2.2.

2.2 EXCESS MATERIALS

- A. Provide owner's authorized rep. With the following excess materials for use in future decomposed granite or 3/8" minus or 1/4" minus crushed aggregate paving repair: 40 to 50 lb. bags of the aggregate paving blended with proper amount of binder.

2.3 LANDSCAPE EDGING MATERIALS

- A. Per Section 329300 Landscape Steel Edging.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Areas receiving paving materials shall be examined for correct and complete base preparation, compaction, grade, pitch, and drainage installation. To prevent path erosion in slope condition, path shall have drainage channel on upside of slope, so that runoff shall not cross path, to allow sufficient drainage runoff.
- B. Prepared subgrade shall be proof rolled to check for unstable conditions and areas requiring additional compaction. The subgrade shall be compacted to a minimum 95% dry density. A compaction test shall be taken at questionable areas identified by the Owner's Representative. If native soil will not sufficiently compact, import Class 2 aggregate base to be wet.
- C. Report unsatisfactory conditions to the Owner's Representative. Do not begin paving work until unsatisfactory conditions have been corrected and is ready to receive paving. Proceeding with the installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.
- D. Herbicide Treatment: Pre-emergence herbicide shall be recommended and applied by a licensed pest control service. Apply herbicide in strict compliance with manufacturer's recommended instructions, and local and state regulations. Apply to compacted, dry, subgrade prior to application of aggregate base course. Do not use weed control chemicals that may stain decomposed granite or surrounding surfaces.

3.2 PREPARATION

- A. Pre-soak base material with water prior to installing stabilized Aggregate Paving material.
- B. Install the specified header or edging material on peripheral edges of area to be paved not already adjacent to a solid surface.

3.3 PLACEMENT

- A. Place the stabilized D.G. on the prepared sub grade, and rake smooth to desired grade and cross section. Place material to sufficient depth to allow approximately 1/4" of compaction for every 2" of loose D.G.
- B. Depth of pathways – 4" for heavy foot traffic and light vehicles.

3.4 WATERING

- A. Areas shall be thoroughly watered as to achieve moisture penetration to the full depth of the paving material. Water is the activation mechanism for binding agent. During water application test water penetration depths with a probing devise. Take care to not underwater, it is not possible to over-water this product, it will however extend the set up time before compaction can take place.

3.5 COMPACTION

- A. Upon thorough moisture penetrations do not begin compaction for at least 6 hours and up to 48 hours after placement or until such time that the paving material is able to accept 85% relative compaction from a 1 to 5 ton roller/compactor without separation, plowing or any other physical compromise of the paving material. Compact the material with compactor as specified above making 3 to 4 passes. Avoid a vibratory plate compactor when possible, however tight spaces may mandate the use of a small handheld unit.
- B. Take care in compacting decomposed granite or crushed 3/8" or 1/4" minus aggregate screenings when adjacent to planting and irrigation systems. Hand tamping with 8" or 10" hand tamp recommended.
- C. Header and Edging Tolerances to Path:
 - 1. Elevation: 1/4 inch.
 - 2. Surface Gap: Minus 1/4 inch.

3.6 INSPECTION

- A. Finished surface of entire pathway shall be smooth, uniform and solid, free of ruts, dips and roller marks with surface of path crowned to allow sufficient water run-off due to irrigation, weather or undue water application. There shall be no evidence of chipping or cracking. Cured and compacted pathway shall be firm throughout profile with no spongy areas. Loose material shall not be present on the surface. Any significant irregularities in path surface shall be repaired to the uniformity of entire installation.
- B. At the end of the day, the installation shall terminate at a paving edge or other transition. No material shall be deposited on paving which has hardened sufficiently to cause the formation of seams, planes, weakness within the section, or visible lines in the finished surface.
- C. Protect the entire area from foot or vehicular traffic until fully dried. Protect the area from contamination or damage by other work in progress.

3.7 MAINTENANCE

- A. Remove debris, such as paper, grass clippings, leaves or other organic material by mechanically blowing or hand raking the surface as needed.
- B. During the first year, a minor amount of loose aggregate will appear on the paving surface. If this material exceeds a 1/4", redistribute the material over the entire surface. Water thoroughly to the depth of 1". Compact with power roller of no less than 1000 lbs. Repeat process as needed.
- C. If cracking occurs, simply sweep fines into the cracks, water thoroughly and hand tamp with an 8" – 10" hand tamp plate.

3.8 REPAIRS

- A. Excavate damaged area to the depth of the stabilized aggregate and square off sidewalls.
- B. If area is dry, moisten damaged portion lightly.
- C. Pre-bend the dry required amount of soil binding agent with the proper amount of aggregate in a concrete mixer.
- D. Add water to the blended mix. Thoroughly moisten mix with 25 to 45 gallons per 1-ton of preblended material or to approximately 10% moisture content.
- E. Apply moistened pre-blended aggregate to excavated area to finish grade.
- F. Compact with an 8" to 10" hand tamp or 250 to 300 pound roller. Keep traffic off areas for 12 to 48 hours after repair has been completed.

END OF SECTION 321540

SECTION 321713 - PARKING BUMPERS

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 wheel stops.

1.3 ACTION SUBMITTALS

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

1.4 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

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 three factory-formed or -drilled vertical holes through wheel stop for anchoring to substrate.
 - 1. Surface Appearance: Free of pockets, sand streaks, honeycombs, and other obvious defects. Corners shall be uniform, straight, and sharp.
 - 2. Mounting Hardware: At each wheel stop provide three galvanized-steel spikes or dowels, 3/4-inch diameter, 10-inch minimum length.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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. Adhesively bond anchors to both wheel stop and pavement.
- D. At asphalt paving, extend upper portion of anchor 4-1/2-inches into wheel stop and a minimum of 5-1/2-inches into pavement.
- E. Recess head of hardware beneath top of wheel stop. Fill recess with sealant per Section 079200 Joint Sealants.

END OF SECTION 321713

SECTION 321723 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section includes painted markings applied to [asphalt] [and] [concrete] pavement.
- C. Product Data: For each type of product.
 - 1. Include technical data and tested physical and performance properties.
- D. Shop Drawings: For pavement markings.
 - 1. Indicate pavement markings, colors, lane separations, defined parking spaces, and dimensions to adjacent work.
 - 2. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.
- E. Court Striping
- F. Pavement marking for play court markings and pedestrian markings.
- G. Related Requirements:
 - 1. Review methods and procedures related to marking pavement including, but not limited to, the following:
 - 2. Pavement aging period before application of pavement markings.
 - a. Review requirements for protecting pavement markings, including restriction of traffic during installation period.
- H. ACTION SUBMITTALS

1.2 REGULATORY REQUIREMENTS

- A. At least one passenger loading zone shall be provided in every continuous 100 linear feet of loading zone space, or fraction thereof, complying with CBC Sections 11B-209 and 11B-503 as follows:
 - 1. Vehicle pull-up spaces shall be 8'x20' minimum. Access aisles shall be 5'x20' minimum and shall be adjacent and parallel to the vehicular pull-up spaces. They shall be at the same level with slopes not steeper than 1:48 in any direction. CBC Section 11B-503.4.
 - 2. Access aisles for passenger drop-off and loading zone shall be marked with a painted borderline around their perimeter. The area within the borderlines shall be marked with hatched lines a maximum of 36" on center in a color contrasting with that of the aisle surface. CBC Section 11B-503.3.
 - 3. A vertical clearance of 9'-6" minimum shall be provided for vehicle pull-up spaces, access aisles, and a vehicular route serving them connecting a vehicular entrance and a vehicular exit. CBC Section 11B-503.5.
- B. Bus loading zones and bus stops shall comply with CBC Sections 11B-209 and 11B810.2 as follows:
 - 1. Boarding and alighting areas shall be of 8' x 5' minimum, with 8' measured perpendicular to the curb or vehicle roadway edge, and with 5' measured parallel to the vehicle roadway. Slopes in 8' direction shall be 1:48 maximum. Slopes in 5' direction shall be the

- same as that of the roadway, to the maximum extent practicable. CBC Figure 11B-810.2.2.
2. Bus shelters shall provide a minimum 30" x 48" clear floor or ground space (36" x 48" or 36" x 60" as applicable in an alcove), with slopes not steeper than 1:48 in any direction, entirely within the shelter complying with CBC Section 11B-305.
 3. Bus shelters shall be connected by an accessible route complying with CBC Section 11B-402 to a boarding and alighting area complying with CBC Section 11B-810.2. CBC Figure 11B-810.3.
- C. Surface slopes of accessible parking spaces and access aisles shall be the minimum possible and shall not exceed 2% slope in any direction. CBC Section 1129 B.3, Item 4.
- D. Loading & unloading access aisle shall be marked by a border painted blue. Within the blue border, hatched lines a maximum of 36" on center shall be painted a color contrasting with the parking surface, preferably blue on concrete paving or white on AC paving per CBC Figures 11B-18A through, 11B-18C.
- E. When blue color is used, it shall conform to Color No. 15090 per Federal Standard 595B.
- F. Comply with materials, workmanship, and other applicable requirements of CBC Title 24 for pavement-marking work.
- G. Accessible parking spaces serving a particular building or facility shall be located on the shortest accessible route to an entrance complying with CBC Section 11B-206.4.
- H. Accessible parking spaces serving more than one accessible entrance shall be dispersed and located on the shortest accessible route to the accessible entrances.
- I. 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 Section 11B-208.3.1
- J. 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.
- K. 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
- L. 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 shall be at the same level with slopes not steeper than 1:48 in any direction. CBC Section 11B-502.4
 2. Parking spaces shall be 9'x18' minimum and van parking spaces shall be 12'x18' minimum with an adjacent access aisle of 5'x18' minimum. Access aisles shall be placed on either side of the parking spaces except be located on the passenger side for van parking spaces. Van parking spaces shall be permitted to be 9'x18' minimum where the access aisle is 8'x18' minimum.
 3. Access aisles shall be marked by a blue painted borderline around their perimeter. The area within the blue borderlines shall be marked with hatched lines a maximum of 36" on center in a color contrasting with that of the aisle surface, preferably blue or white. Access aisle markings may extend beyond the minimum required length. CBC Section 11B-502.3.3

4. Access aisles (accessible parking spaces as well as similar application) shall not overlap the vehicular way. CBC Section 11B-502.3.4
 5. A vertical clearance of 8'-2" minimum shall be provided for accessible parking spaces, access aisles, and vehicular routes serving them. CBC Section 11B-502.
- M. At least one passenger loading zone shall be provided in every continuous 100 linear feet of loading zone space, or fraction thereof, complying with CBC Sections 11B-209 and 11B-503 as follows:
1. Vehicle pull-up spaces shall be 8' x 20' minimum.
 2. Access aisles shall be 5' wide minimum x full length of vehicle pull-up spaces they serve and shall be adjacent and parallel to the vehicle pull-up spaces. They shall be at the same level with each other and with slopes not steeper than 1:48 in any direction. Access aisle shall adjoin an accessible route and shall not overlap the vehicular way.
 3. Access aisles for passenger drop-off and loading zone shall be marked with a painted borderline around their perimeter. The area within the borderlines shall be marked with hatched lines a maximum of 36" on center in a color contrasting with that of the aisle surface. CBC Section 11B-503.3.3
 4. A vertical clearance of 9'-6" minimum shall be provided for vehicle pull-up spaces, access aisles, and a vehicular route serving them connecting a vehicular entrance and a vehicular exit. CBC Section 11B-503.5
- N. Bus loading zones and bus stops shall comply with CBC Sections 11B-209 and 11B-810.2 as follows:
1. Bus boarding and alighting areas shall be of 8' x 5' minimum, with 8' measured perpendicular to the curb or vehicle roadway edge, and with 5' measured parallel to the vehicle roadway. Slopes in 8' direction shall be 1:48 maximum. Slopes in 5' direction shall be the same as that of the roadway, to the maximum extent practicable. CBC Figure 11B-810.2.2
 2. Bus shelters shall provide a minimum 30' x 48' clear floor or ground space (36' x 48' or 36' x 60' in an alcove per CBC 11B-305.7), with slopes not steeper than 1:48 in any direction, entirely within the shelter complying with CBC Section 11B-305.
 3. Bus shelters shall be connected by an accessible route complying with CBC Section 11B-402 to a boarding and alighting area complying with CBC Section 11B-810.2 and Figure 11B-810.3.
 4. Newly constructed bus stop boarding and alighting areas shall provide a detectable transition between the boarding/alighting area and the roadway; the detectable transition shall consist of a curb with the face sloped at 35 degrees maximum from vertical or detectable warnings complying with CBC Sections 11B-705.1.1 and 11B-705.1.2.4.
- O. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of <Insert applicable standards> of <Insert name of state or local DOT> for pavement-marking work.
1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.
 2. FIELD CONDITIONS

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

Murrieta Elementary School New CR Bldg
 Murrieta Valley Unified School District
 BakerNowicki Design Studio #18009-00

PAVEMENT MARKINGS
 321723 – 3

1. Dunn-Edwards Corporation.
2. Sherwin-Williams Company (The).
3. Vista Paint.
4. Or Equal.

2.2 PAVEMENT-MARKING PAINT

- A. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952E, Type II, with drying time of less than 30 minutes.
 1. Color: White, Yellow, Blue, Red and as indicated.
- B. Provide paint specifically formulated for use as pavement marking in automobile, pedestrian traffic and play court areas, and as required by jurisdictional authority.
- C. Provide striping in size and multiple colors as selected by Architect, and as follows:
 1. At all pavement markings associated with accessibility for the disabled, provide Federal Blue 15090 per FS 595C color as defined in Title 24, Part 2, CCR, 4 inch width. Provide accessible aisle markings at 36 inches on center.
 2. Provide red color at fire lane curbs and striping, with message "FIRE LANE - DO NOT BLOCK".
 3. Provide white striping at parking space markings, 4 inch width.
 4. Provide directional arrows, white color, size as shown on drawings.
- D. Paint products shall comply with Section 210-1.6 of the "Standard Specifications," Section 91, CalTrans Standard Specifications, for "rapid-dry" type paints. Paint manufacturer shall provide written certification of conformance to standard.
- E. Reflectorized beading not required, except where required at public improvements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that pavement is dry and in suitable condition to begin pavement marking according to manufacturer's written instructions.
- B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Secure the Architect's approval of graphics design and layout prior to start of application, including compliance with accessibility standards of Title 24.
- B. Secure Fire Marshal approval of all striping and marking of curbs, pavement, and related signage.
- C. Accessible parking spaces shall be marked according to 2019 CBC Section 11B-502.6.
- D. Verify that concrete curing compound and asphalt seal coat compound has become completely inert prior to painting. Remove by approved means for those areas where compound is still active.

3.3 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

- B. Allow paving to age for a minimum of 3 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, firmly secured to pavement. Mask an extended area beyond edges of each stencil to prevent paint application beyond the stencil. Apply paint so that it cannot run beneath the stencil.
- E. Coatings installed on asphalt paving shall be applied in thin, light coats to avoid peeling.
- F. Repaint markings damaged by construction traffic.
- G. Install fire lane curb markings at locations required by Fire Marshal or at 20 feet on center, whichever is more restrictive.
- H. Install markings within 1/2 inch tolerance. Maintain width to a tolerance of plus/minus 1/4 inch.

3.4 PROTECTING AND CLEANING

- A. Protect pavement markings from damage and wear during remainder of construction period.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 321723

SECTION 321726 - TACTILE WARNING SURFACING

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. Cast-in-place detectable warning tiles.
- B. Related Requirements:
 - 1. Section 321313 "Concrete Paving" for concrete walkways serving as substrates for tactile warning tiles or pavers.

1.3 ACTION SUBMITTALS

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

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For tactile warning surfacing, to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Surface-applied detectable warning tiles or mats are not permitted.
- B. Tactile Warning Surfacing shall have a coefficient of friction of 0.6 minimum when tested in accordance with ASTM C 1028.

1.6 Regulatory Requirements.

- A. Detectable warning surfaces shall comply with CBC Section 11B-705.1.
- B. Detectable warning surfaces at transit boarding platform edges, bus stops, hazardous vehicular areas, reflecting pools, and track crossings shall be yellow and approximate FS 33538 of Federal Standard 595C. Detectable warning surfaces at other locations shall be either the aforementioned yellow or a color providing a 70 percent minimum visual contrast with that of adjacent walking surfaces. The material used to provide visual contrast shall be an integral part of the surface. CBC Section 11B-705.1.1.3
- C. Detectable warning surfaces shall differ from adjoining surfaces in resiliency or sound-on-cane contact. Such constraint shall not be required for detectable warning surfaces at curb ramps, islands, or cut-through medians. CBC Section 11B-705.1.1.4
- D. Provide minimum 5 year warranty per DSA Bulletin 10/31/02, revised 04/09/08.

1.7 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.

1.8 WARRANTY

- A. Manufacturer's certification that indicates compliance with the architectural access standards as published in the current edition of the CBC.
- B. 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. Deterioration of durability criteria as listed below.
 - c. Separation or delamination of materials and components.
 - 2. Warranty Period: Provide a minimum five year warranty from date of Substantial Completion of durability criteria, including shape, color fastness, confirmation, sound-on-cane acoustic quality, resilience and attachment, per DSA Bulletin 10/31/02 revised 4/9/08.

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 the CBC 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, joint material, setting material, anchor, and fasteners from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

2.2 DETECTABLE WARNING TILES

- A. Cast-in-Place Detectable Warning Tiles: Accessible truncated-dome detectable warning tiles configured for setting flush in new concrete walkway surfaces, with slip-resistant surface treatment on domes and field of tile.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armorcast Products Company.
 - b. Detectable Warning Systems, Inc.
 - c. StrongGo Industries, LLC.
 - d. Or Equal.
 - 2. Material: Cast-fiber-reinforced polymer concrete tile.
 - 3. Color: Safety yellow.
 - a. Color No. 33538 per Federal Standard 595C.
 - b. Color must be integral throughout the tile and not surface applied.
 - 4. Sizes:
 - a. Rectangular panel, 36 by 48 inches or as required per plan.

5. Dome Spacing and Configuration:
 - a. 2.35-inch center-to-center spacing in all directions and across adjacent tiles.
 - b. Round truncated dome configuration, 0.9" (22 mm) diameter at base and 0.45" (11 mm) diameter at top.
 - c. Truncated dome height: 0.2" (5 mm).
 - d. Layout: Square layout within the tile and square to the direction of travel.
6. Mounting:
 - a. Permanently embedded detectable warning tile wet-set into freshly poured concrete.

2.3 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 304 stainless-steel fasteners for exterior use.
 2. Fastener Heads: For nonstructural connections, use only flush, 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.
- C. Provide expansion joints around perimeter of precast concrete tiles and at 8' on center maximum in both directions.
- D. Installation must comply with the architectural access standards as published in the current edition of the CBC.

3.3 INSTALLATION OF DETECTABLE WARNING TILES

- A. Cast-in-Place Detectable Warning Tiles:
 1. Concrete Paving Installation: Comply with installation requirements in Section 321313 "Concrete Paving." Mix, place, and finish concrete to conditions complying with detectable warning tile manufacturer's written requirements for satisfactory embedment of tile.

2. Set each detectable warning tile accurately and firmly in place and completely seat tile back and embedments in wet concrete by tamping or vibrating. If necessary, temporarily apply weight to tiles to ensure full contact with concrete.
3. Set surface of tile flush with surrounding concrete and adjacent tiles, with variations between tiles and between concrete and tiles not exceeding plus or minus 1/8 inch from flush.
4. Protect exposed surfaces of installed tiles from contact with wet concrete. Complete finishing of concrete paving surrounding tiles. Remove concrete from tile surfaces.
5. Clean tiles using methods recommended in writing by manufacturer.

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. Replace using tactile warning surfacing installation methods acceptable to District Construction Manager.
- B. Protect tactile warning surfacing from damage and maintain free of stains, discoloration, dirt, and other foreign material.

END OF SECTION 321726

SECTION 321816.13 - PLAYGROUND PROTECTIVE SURFACING

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. Unitary, seamless surfacing.

1.3 DEFINITIONS

- A. Definitions in ASTM F 2223 apply to Work of this Section.
- B. Critical Height: Standard measure of shock attenuation according to ASTM F 2223; same as "critical fall height" in ASTM F 1292. According to ASTM F 1292, this approximates "the maximum fall height from which a life-threatening head injury would not be expected to occur."
- C. CPSC: Consumer Product Safety Commission.
- D. Fall Height: According to ASTM F 1487, this means "the vertical distance between a designated play surface and the protective surfacing beneath it." The fall height of playground equipment should not exceed the Critical Height of the protective surfacing beneath it.
- E. IPEMA: International Playground Equipment Manufacturers Association.
- F. SBR: Styrene-butadiene rubber.
- G. Unitary Surfacing: A protective surfacing of one or more material components bound together to form a continuous surface; same as "unitary system" in ASTM F 2223.
- H. Use Zone: According to ASTM F 1487, this means "the area beneath and immediately adjacent to a play structure that is designated for unrestricted circulation around the equipment and on whose surface it is predicted that a user would land when falling from or exiting the equipment."

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of protective surfacing.
 - 1. Include plans, sections, placement and penetration details, and attachment to substrates.
 - 2. Include accessories and edge terminations.
 - 3. Include fall heights and use zones for equipment and structures specified in Section 116800 "Play Field Equipment and Structures," coordinated with the critical heights for protective surfacing.
- C. Samples for Initial Selection: For each type of exposed finish.
 - 1. Include Samples of accessories involving color selection.
- D. Samples for Verification: For each type of protective surfacing and exposed finish.
 - 1. Include Samples of accessories to verify color and finish selection.
 - 2. Unitary, Seamless Surfacing: Minimum 6 by 6 inches.

- E. Product Schedule: For protective surfacing. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data for Installer: Include Certification by manufacturer that installer is an approved applicator of the unitary surfacing product.
- B. Product Certificates: For each type of unitary surfacing product, signed by a qualified testing agency.
 - 1. ASTM F1292 Impact Attenuation Test Certification for Surface Systems Under and Around Playground Equipment, in compliance with the Critical Fall Heights, as determined by the specific heights of playground equipment specified in Section 116800 "Play Field Equipment and Structures.
 - 2. ASTM 1951 Certificate of Determination of Accessibility of Surface Systems Under and Around Playground Equipment.
- C. Manufacturer's Certificates: For each type of unitary surfacing product, signed by the manufacturer, certifying products furnished comply with requirements.
- D. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For playground protective surfacing to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Regulatory Requirements.
 - 1. Ground surfaces on accessible routes, clear floor or ground spaces, and turning spaces for play areas shall comply with CBC Section 11B-1008.2.6 as follows:
 - a. Ground surfaces shall be inspected and maintained regularly and frequently to ensure continued compliance with ASTM F 1951.
 - b. Ground surfaces located within use zones shall comply with ASTM F 1292 (1991 edition or 2004 edition).

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply unitary surfacing system materials or components over wet or damp substrates.
- B. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit unitary surfacing system installation to be performed according to manufacturer's written instructions and warranty requirements.

1.9 WARRANTY

- A. Special Warranty: Manufacturer and Installer agree to repair or replace components of protective surfacing that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Reduction in impact attenuation as measured by reduction of critical fall height.
 - b. Deterioration of protective surfacing and other materials beyond normal weathering.
 - 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain protective surfacing materials from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Provide unitary surfacing systems that comply with the following:
 - 1. Impact Attenuation: Critical fall height tested according to ASTM F 1292.
 - 2. Accessibility Standard: Minimum surfacing performance according to ASTM F 1951.
 - 3. Safety Standard: CPSC Publication #325 Public Playground Safety Handbook.
 - 4. IPEMA certified.

2.3 UNITARY, DUAL-DENSITY, SEAMLESS SURFACING

- A. Description: Manufacturer's standard, site-mixed and applied, two-layer material with wearing layer over cushioning layer, with combined, overall thickness as required, tested for impact attenuation according to ASTM F 1292 and for accessibility according to ASTM F 1951.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Progressive Design Playgrounds dba PDPlay.
 - b. TotTurf, a Playcore Company.
 - c. Surface America Incorporated.
 - d. Or equal.
 - 2. Wearing Layer: Formulation of recycled EPDM rubber particles and aliphatic polyurethane binder, minimum 1/2- inch thick.
 - 3. Cushioning Layer: Formulation of recycled SBR particles and polyurethane binder.
 - 4. Critical Height: 8 feet minimum, coordinate with approved equipment and structures specified in Section 116800 "Play Field Equipment and Structures,".
 - 5. Overall Thickness: As required for critical height indicated but not less than 2 inches.
 - 6. Primer/Adhesive: Manufacturer's standard primer and weather-resistant, moisture-cured polyurethane adhesive suitable for unit, substrate, and location.
 - 7. Wearing Layer Color(s): As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for subgrade elevations, slope, and drainage and for other conditions affecting performance of the Work.
 - 1. Verify that substrates are sound and without high spots, ridges, holes, and depressions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates to receive surfacing products according to protective surfacing manufacturer's written instructions.

3.3 INSTALLATION OF SEAMLESS SURFACING

- A. Mix and apply components of seamless surfacing according to manufacturer's written instructions to produce uniform, monolithic, and impact-attenuating protective surfacing of required overall thickness.
 - 1. Substrate Primer: Apply over prepared substrate at manufacturer's standard spreading rate for type of substrate.
 - 2. Poured Cushioning Layer: Spread evenly over primed substrate to form a uniform layer applied at manufacturer's standard spreading rate in one continuous operation, with a minimum of cold joints.
 - 3. Intercoat Primer: Over cured cushioning layer, apply primer at manufacturer's standard spreading rate.
 - 4. Wearing Layer: Spread over primed base course to form a uniform layer applied at manufacturer's standard spreading rate in one continuous operation and, except where color changes, with no cold joints. Finish surface to produce manufacturer's standard wearing-surface texture.
 - 5. Edge Treatment: As indicated on Drawings. Fully adhere edges to substrate with full coverage of substrate. Maintain fully cushioned thickness required to comply with performance requirements.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: District will engage a qualified playground safety inspector, certified by the National Playground Safety Institute, to perform tests and inspections.
- B. Playground protective surfacing will be considered defective if it does not pass tests.

3.5 PROTECTION AND CLEANING

- A. Prevent traffic over seamless surfacing for not less than 48 hours after installation. Protect unitary surfacing system from damage and wear during the remainder of construction period. Clean unitary surfacing system after time period recommended in writing by manufacturer but not more than four days before dates scheduled for inspections intended to establish date of Substantial Completion. Use cleaning materials and procedures recommended in writing by unitary surfacing system manufacturer.
 - 1. During installation of adhesively applied products, immediately remove visible adhesive from surfaces. Use cleaner recommended by unitary surfacing system manufacturer.

END OF SECTION 321816.13

SECTION 323113 - CHAIN LINK FENCES AND GATES

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. Chain-link fences.
 - 2. Swing gates.
 - 3. Privacy slats.
- B. Related Requirements:
 - 1. Section 033000 "Cast-in-Place Concrete for cast-in-place concrete post footings.

1.3 PRE-INSTALLATION MEETINGS

- A. Pre-installation Conference: Conduct conference at Project site.
 - 1. Review required testing, inspecting, and certifying procedures.

1.4 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 the following:
 - a. Fence and gate posts, rails, and fittings.
 - b. Chain-link fabric, reinforcements, and attachments.
 - c. Accessories: Privacy slats.
 - d. Gates and hardware.
- B. Shop Drawings: For each type of fence and gate assembly.
 - 1. Include plans, elevations, sections, details, and attachments to other work. Show locations of gates, posts, rails, and tension wires, and details of gate swing, or other operation, hardware, and accessories.
 - 2. Indicate materials, dimensions, sizes, weights, and finishes of components.
 - 3. Include accessories, hardware, gate operation, and operational clearances.
- C. Samples for Initial Selection: For each type of factory-applied finish.
- D. Samples for Verification: For each type of component with factory-applied finish, prepared on Samples of size indicated below:
 - 1. Privacy Slats: In 6-inch lengths.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Product Certificates: For each type of chain-link fence and gate.
- C. Product Test Reports: For framework strength according to ASTM F 1043, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.
- D. Field quality-control reports.

- E. Sample Warranty: For special warranty.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing fence grounding; member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.
- B. Emergency Access Requirements: Comply with requirements of the Division of the State Architect (DSA) for gates serving as a required means of access.
- C. Post and rail piping shall not be installed until the Project Inspector verifies that the material meets the specified weight per lineal foot for each pipe size to be used.
- D. Post footing excavations shall be approved by the Project Inspector prior to setting any posts.
- E. Regulatory Requirements:
 - 1. Gates that are part of the accessible route shall meet all the requirements of an accessible door in compliance with CBC Section 11B-404.
 - 2. The levers of lever actuated latches or locks for accessible gates shall be curved with a return to within ½" 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).
 - 3. Swing doors and gate surfaces within 10" of the finish floor or ground shall have a smooth surface on the push side extending the full width of the door or gate. Parts creating horizontal or vertical joints in these surfaces shall be within 1/16" of the same plane as the other and be free of sharp or abrasive edges. Cavities created by added kick plates shall be capped. CBC Section 11B-404.2.10

1.7 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.

1.8 WARRANTY

- A. Special Warranty: Manufacturer and Installer agree 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, the following:
 - a. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - b. Fabric bowing, sagging, breakage or similar defects.
 - c. Fence framework failure.
 - d. Faulty operation of gate hardware.
 - e.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Lightning Protection System: Maximum resistance-to-ground value of 25 ohms at each grounding location along fence under normal dry conditions.

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 according to "CLFMI Product Manual" and requirements indicated below:
1. Fabric Height: As indicated on Drawings.
 2. Steel Wire for Fabric: Wire diameter of 0.148 inch.
 - a. Mesh Size:
 - 1) Fence Fabric:
 - a) 2 inch.
 - b. Zinc-Coated Fabric: ASTM A 392, Type II, Class 2, 2.0 oz./sq. ft. with zinc coating applied after weaving.
 3. Selvage: Knuckled at both selvages.

2.3 FENCE FRAMEWORK

- A. Posts and Rails: ASTM F 1043 for framework, including rails, braces, and line; terminal; gate; 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. Heavy-Industrial-Strength Material: Group IA, round steel pipe, Schedule 40.
 - a. Thread protectors shall not be used as couplings under any circumstances.
 - b. All pipe used in chain link fencing shall be stamped by the manufacturer, either with indelible ink or incused, indicating the pipe wall thickness, inside diameter, ASTM standard to which it conforms, and the manufacturer's name.
 - c. Line Post: 2.375 inches in diameter.
 - d. End, Corner, Gate, and Pull Posts: 2.875 inches in diameter.
 - e. Flanging of end (terminal) posts:
 - 1) Terminal posts and gate posts shall only be flanged to assist in relocatable building moves.
 - 2) A larger pipe shall be dropped over a smaller post only when a short run of existing fencing is terminated and when digging a new hole to install a bigger terminal post is impractical. This shall be used as a temporary repair, not as a permanent repair or installation.
 - 3) If it is necessary to create a removable section of fence (to assist in relocatable building moves), a smaller pipe shall be sleeved into a smaller line post.
 - 4) Sleeves sizes shall conform to ASTM A53, Schedule 40.
 - a) For a 2-inch Interior Diameter (ID) sleeve, insert 1 ½" ID pipe.
 - b) For a 2-1/2-inch ID sleeve, insert 2-inch ID pipe.
 - c) For a 3-inch ID sleeve, insert a 2 ½-inch ID pipe.
 3. Horizontal Framework Members: Comply with ASTM F 1043.
 - a. Top Rails: Provide at all chain-link fencing. Fabricate top rail from lengths 21 feet or longer, with wedged-end or fabricated for expansion-type coupling, forming a continuous rail along top of chain-link fabric. Provide expansion couplings 6 inches long at each joint in top rails.
 - b. Intermediate Rails: Provide at tennis court and multi-purpose court wall fencing, and where indicated. Match top rail for finish and size.
 - c. Bottom Rails: Provide at athletic field, tennis and handball court, and multi-purpose court wall fencing. Also provide where decomposed granite, grass,

planters and synthetic fields about any fence line. Match top rail for finish and size.

4. Top Rails, Intermediate Rails, Bottom Rails and Brace Rails: 1.66 inches in diameter.
5. Post Brace Rails: Provide brace rail with truss rod assembly for each gate, end, and pull post. Provide two brace rails extending in opposing directions, each with truss rod assembly, for each corner post and for pull posts. Provide rail ends and clamps for attaching rails to posts.
6. Metallic Coating for Steel Framework:
 - a. Type A: Not less than minimum 2.0-oz./sq. ft. average zinc coating according to ASTM A 123/A 123M; internal and external; hot-dipped after fabrication.
7. Polymer coating over metallic coating.
 - a. Color: As selected by Architect from manufacturer's full range, according to ASTM F 934.
8. Schedule of Pipe Sizes: See following Table 1.

B. TABLE 1

C. ASTM A53 Threaded and Coupled Pipe

Nominal Size	Outside Diameter		Wall Thickness			Weight		
Inches	Inches	mm	Inch	mm	No	lb/ft	Kg/m	Kg/ft
1/2"	0.084	21.3	0.109	2.77	40 (STD)	0.85	1.26	0.39
			0.147	3.73	80 (XS)	1.09	1.62	0.49
3/4"	1.050	26.7	0.113	2.87	40 (STD)	1.13	1.68	0.51
			0.154	3.91	80 (XS)	1.48	2.20	0.67
1"	1.315	33.4	0.133	3.38	40 (STD)	1.68	2.50	0.76
			0.179	4.55	80 (XS)	2.18	3.24	0.99
1 1/4"	1.660	42.2	0.140	3.56	40 (STD)	2.288	3.39	1.04
			0.191	4.85	80 (XS)	3.02	4.49	1.37
1 1/2"	1.900	48.3	0.145	3.68	40 (STD)	2.73	4.06	1.24
			0.200	5.08	80 (XS)	3.66	5.45	1.66
2"	2.375	60.3	0.154	3.91	40 (STD)	3.68	5.42	1.67
			0.208	5.54	80 (XS)	5.07	7.55	2.30
2 1/2"	2.875	73.0	0.203	5.16	40 (STD)	5.82	8.66	2.64
			0.276	7.01	80 (XS)	7.73	11.50	3.51
3"	3.500	88.9	0.216	5.49	40 (STD)	7.62	11.34	3.46
			0.300	7.62	80 (XS)	10.33	15.37	4.69
3 1/2"	4.000	101.6	0.226	5.74	40 (STD)	9.2	13.69	4.18
			0.318	8.08	80 (XS)	12.63	18.80	5.73
4"	4.500	114.3	0.237	6.02	40 (STD)	10.89	16.21	4.94
			0.337	8.56	80 (XS)	15.17	22.58	6.89
6"	6.625	168.3	0.280	7.11	40 (STD)	18.97	28.23	8.60
			0.312	7.92	80 (XS)	21.04	31.31	9.54

D. Black and Galvanized 1/2" to 6"

2.4 TENSION WIRE

- A. General: Provide horizontal bottom tension wire at all fence fabric not having a bottom rail.
- B. 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 II: Zinc coated (galvanized) by hot-dip process, with a Class 4 minimum coating weight; not less than 1.2 oz./sq. ft. of uncoated wire surface.
- C. Polymer-Coated Steel Wire: 0.177-inch-diameter, tension wire according to ASTM F 1664, Class 2a or 2b over zinc-coated steel wire.
 - 1. Color: Match chain-link fabric, according to ASTM F 934.

2.5 SWING GATES

- A. General: Comply with ASTM F 900 for gate posts and single double swing gate types. See Table 2 for sizes.
 - 1. Gate Leaf Width: As indicated.
- B. Pipe and Tubing:
 - 1. Zinc-Coated Steel: ASTM A 53, ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence framework; Schedule 40.
 - 2. Gate Posts: Round hot-dipped galvanized tubular steel with inside dimensions and weight according to Table 2 for the gate leaf widths required.
 - a. All gate posts shall be of sufficient strength so that the total deflection of the gate and the post at the end of the gate leaf shall not exceed the lesser of 2% of the gate leaf width or 4 inches.
 - b. When necessary to meet this requirement due to the total weight of the gate leaf, the next larger size posts required shall be used. Gates shall not be equipped with rollers or casters for support.
 - 3. Gate Frames and Bracing: Round hot-dipped galvanized tubular steel with minimum diameter of 1.900-inch. Provide diagonal cross-bracing, consisting of 3/8-inch diameter adjustable-length truss rods on welded gate frames, where necessary to obtain frame rigidity without sag or twist.
- C. Frame Corner Construction: Welded, with 5/16-inch diameter adjustable truss rods for panels 5 feet wide or wider.

D. TABLE 2

Swing gate member sizes		
Gate opening	Nominal size	lb/ft.
Single leaf to 6 feet	2 1/2"	5.79
Double leaf to 12 feet opening		
Single leaf 6 to 13 feet	3 1/2"	9.11
Double leaf 12 to 26 feet opening		
Single leaf 13 to 18 feet	6"	18.97
Double leaf 26 to 36 feet opening		

- E. Hardware:
 - 1. Hinges: Heavy-duty offset, with 180-degree outward swing or as indicated.
 - a. In addition to bolting, spotweld all hinges to posts.
 - 2. Latch: Permitting operation from both sides of gate.

- a. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.
- b. Single latches shall be industrial gravity type gate latch with automatic stop.
- c. Double latch shall be drop bar 1.315-inch diameter nominal pipe size securely bolted to gate frame and shall engage an iron gate stop. Drop bar shall engage 1.900-inch pipe diameter pipe sleeve set in concrete. Provide drop bar keeper on gate to secure it in lifted position.
- d. In addition to bolting, spotweld all latches to posts.
- 3. Padlock and Chain:
 - a. Provide means of padlocking gates in the open position where indicated that gate must be locked in open position during activity hours.
 - b. Chains: Provide each gate with 3-foot length of chain to secure gate to fence with a padlock when open. Install 3/4-inch round eye, cadmium plated harness snap on one end of chain. Secure chain with spot weld.
- 4. All screws and bolts shall be tamper-proof.
- 5. Provide center gate stops.
- 6. For all gates more than 5 feet wide, provide keepers.
- 7. Hardware for gates that are part of the access or egress system:
 - a. Gates (in Path-of-Travel), hardware, maneuvering clearances, and operation shall comply with applicable portions of CBC accessibility requirements.
 - b. Omit latch and make provisions to receive exit device hardware.
 - c. Provide 16 gage steel plate for mounting of exit device on gate and exit device latch on post. Size plate to protect against unauthorized operation of the exit device from the exterior as shown.
 - d. Closer: Refer to Section 087100 Door Hardware• Specification for detailed hardware requirements.
 - e. Mount operating hardware at minimum 34 inches and maximum 44 inches above grade or pavement surface.

2.6 FITTINGS

- A. Provide fittings according to ASTM F 626.
- B. Post and Line Caps: Hot-dipped galvanized pressed steel or hot-dipped galvanized cast iron. Provide weathertight closure cap for each post.
 - 1. Provide line post caps with loop to receive top rail.
- C. Rail and Brace Ends: Hot-dipped galvanized pressed steel or hot-dipped galvanized cast iron. Provide rail ends or other means for attaching rails securely to each gate, corner, pull, and end post.
- D. Rail Fittings: Provide the following:
 - 1. Top Rail Sleeves: Hot-dipped galvanized pressed steel or hot-dipped galvanized round-steel tubing not less than 6 inches long.
 - 2. Rail Clamps: Hot-dipped galvanized pressed steel. Provide line and corner boulevard clamps for connecting intermediate and bottom rails to posts.
- E. Tension and Brace Bands: Hot-dip galvanized pressed steel. Provide bands with projecting edges chamfered or eased.
- F. Tension Bars: Hot-dipped galvanized steel, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.

- G. Truss Rod Assemblies: Steel, hot-dip galvanized after threading, rod and turnbuckle or other means of adjustment.
 - H. Tie Wires, Clips, and Fasteners: According to ASTM F 626.
 - 1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, according to the following:
 - a. Hot-Dip Galvanized Steel: 0.148-inch-diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.
 - I. Finish:
 - 1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz./sq. ft. of zinc.
- 2.7 PRIVACY SLATS
- A. Fiber-Glass-Reinforced Plastic Slats: UV-light-stabilized fiber-glass-reinforced plastic, not less than 0.06 inch thick, sized to fit mesh specified for direction indicated, with vandal-resistant fasteners and lock strips.
 - B. Color: As selected by Architect from manufacturer's full range.
- 2.8 CAST-IN-PLACE CONCRETE
- A. General: Comply with ACI 301 for cast-in-place concrete.
 - B. Materials: Portland cement complying with ASTM C 150 Type II, aggregates complying with ASTM C 33, and potable water for ready-mixed concrete complying with ASTM C 94.
 - 1. Concrete Mixes: Normal-weight concrete with not less than 3000-psi compressive strength (28 days), 4-inch slump, and 1-inch maximum size aggregate.
- 2.9 GROUT AND ANCHORING CEMENT
- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout, recommended in writing by manufacturer, for exterior applications.
 - B. 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. 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.
- 2.10 GROUNDING MATERIALS
- A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."
 - B. Connectors and Grounding Rods: Listed and labeled for complying with UL 467.
 - 1. Connectors for Below-Grade Use: Exothermic welded type.
 - 2. Grounding Rods: Copper-clad steel, 5/8 by 96 inches.
- 2.11 KNOX BOX LOCK
- A. MANUFACTURER:
 - 1. Provide Knox Company, www.knoxbox.com/, or equal.
 - B. SERIES
 - 1. Frame or masonry wall conditions: Series 3200 Recessed Mounting, UL Listed, powder coat finish, color as selected by Architect.

2. Fence panel conditions: Series 3200 Surface Mounting, UL Listed, powder coat finish, color as selected by Architect.

2.12 OTHER MATERIALS

- A. Galvanizing Repair Material: Cold-applied, zinc-rich coating conforming to ASTM A 780.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for a certified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.
 1. Do not begin installation before final grading is completed unless otherwise permitted by District Construction Manager.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.
- B. Clear fence line of trees, brush, and other obstacles to install fencing. Establish a graded, compacted fence line prior to fencing installation.

3.3 CHAIN-LINK FENCE INSTALLATION

- A. Install chain-link fencing according to ASTM F 567 and more stringent requirements specified.
 1. Install fencing on established boundary lines inside property line.
- B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
 1. If rock is encountered, excavate in accordance with 312000 Earth Moving.
- C. Post Setting: Set posts in concrete footings at indicated spacing into firm, undisturbed or compacted soil. Using mechanical devices to set line posts per ASTM F 567 is not permitted.
 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 until concrete is sufficiently cured.
 - 2.
 3. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
 - a. Dimensions and Profile: As indicated on Drawings. Install concrete footings at all fence posts.
 - 1) Line Posts:
 - a) Fabric less than six feet high: 30 inch deep x 8 inch diameter.
 - b) Fabric six to nine feet high: 36 inch deep x 10 inch diameter.
 - c)
 - 2) Corner, Gate and Terminal Posts:
 - a) Fabric less than six feet high: 36 inch deep x 12 inch diameter.
 - b) Fabric six to nine feet high: 42 inch deep x 14 inch diameter.

- b. Exposed Concrete: Extend 2 inches above grade; shape and smooth to shed water. Keep exposed concrete moist for at least 7 calendar days after placement, or cured with an approved membrane curing material.
 - c. Concealed Concrete: Place top of concrete 2 inches below grade to allow covering with surface material.
 - d. Posts Set into Sleeves in Concrete: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed according to anchoring material manufacturer's written instructions. Finish anchorage joint to slope away from post to drain water.
 - e. Posts Set into Holes in Concrete: Form or core drill holes to depth indicated on drawings and 3/4 inch larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed according to anchoring material manufacturer's written instructions. Finish anchorage joint to slope away from post to drain water.
- D. Terminal Posts: Install terminal end, corner, and gate posts according to ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more. For runs exceeding 500 feet, space pull posts an equal distance between corner or end posts.
- E. Line Posts: Space line posts uniformly as follows:
 - 1. Standard fencing: 10 feet o.c.
- F. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.
 - 1. Locate horizontal braces at midheight of fabric 72 inches or higher, on fences with top rail, and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
- G. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch-diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:
 - 1. Extended along bottom of fence fabric. Install bottom tension wire within 6 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.
- H. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.
- I. Intermediate Rails: Where indicated, install in one piece at post-height center span, spanning between posts, using fittings, special offset fittings, and accessories.
- J. Bottom Rails: Where indicated, install and secure to posts with fittings.
- K. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 2-inch bottom clearance between finish grade or surface and bottom selvage, unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains

under tension after pulling force is released. Do not allow fabric to be in contact with finish grade.

- L. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts, with tension bands spaced not more than 15 inches o.c.
- M. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric according to ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
 - 1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.
- N. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.
- O. Privacy Slats: Install slats in direction indicated, securely locked in place.
 - 1. Vertically, for privacy factor of 70 to 75.

3.4 GATE INSTALLATION

- A. 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.

3.5 GROUNDING AND BONDING

- A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Fences Enclosing Electrical Power Distribution Equipment: Ground according to IEEE C2 unless otherwise indicated.
- C. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.
- D. Connections:
 - 1. Make connections with clean, bare metal at points of contact.
 - 2. Make above-grade ground connections with mechanical fasteners.
 - 3. Make below-grade ground connections with exothermic welds.
 - 4. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests.
- B. Prepare test reports.

3.7 TOLERANCES

- A. Maximum Offset From True Position: 1 inch.
- B. Maximum Variation From Plumb: 1/4 inch. Vertical post tolerance of 1/4 inch shall be after the fabric has been stretched.
- C. Components shall not infringe adjacent property lines.

3.8 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.

3.9 GALVANIZING REPAIR

- A. Clean and repair galvanized surfaces damaged by welding or abrasion, cut ends of fabric, and other cut sections with specified galvanizing repair material applied in conformance with manufacturer's printed instructions.

3.10 DEMONSTRATION

- A. Engage a factory-authorized service representative to train District's maintenance personnel to adjust, operate, and maintain chain-link fences and gates.

END OF SECTION 323113

SECTION 323119 - DECORATIVE METAL FENCES AND GATES

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. Decorative metallic-coated steel tubular picket fences and gates.

1.3 PERFORMANCE REQUIREMENTS

- A. Lightning-Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For gates. Include plans, elevations, sections, details, and attachments to other work. Samples: For each fence material and for each color specified.
 - 1. Provide Samples 12 inches in length for linear materials.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.

1.6 REGULATORY REQUIREMENTS

- 1. Gates that are part of the accessible route shall meet all the requirements of an accessible door in compliance with CBC Section 11B-404.
- 2. The levers of lever actuated latches or locks for accessible gates shall be curved with a return to within ½" 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).
- 3. Swing doors and gate surfaces within 10" of the finish floor or ground shall have a smooth surface on the push side extending the full width of the door or gate. Parts creating horizontal or vertical joints in these surfaces shall be within 1/16" of the same plane as the other and be free of sharp or abrasive edges. Cavities created by added kick plates shall be capped. CBC Section 11B-404.2.10

PART 2 - PRODUCTS.

2.1 MANUFACTURER

- A. Basis of Design: Characteristics of specific products, where named in this Section, are indicated to establish required level of quality, appearance, and performance. The Architect will consider comparable products by alternate manufacturers where listed, and requests for substitutions, under the provisions of Section 012500.

B.

- C. DECORATIVE METAL FENCES AND GATES

1. Manufacturer: Ameristar Fence Products, Inc., Tulsa, OK, (888) 333-3422, www.ameristarfence.com.
2. Type: Montage II weldable and rackable ornamental steel, genesis design, 3 rail system, extended picket bottom rail treatment or equal.

2.2 STEEL

- A. Steel material for fence panels and posts shall conform to the requirements of ASTM A653/A653M, with a minimum yield strength of 45,000 psi (310 MPa) and a minimum zinc (hot-dip galvanized) coating weight of 0.90 oz/ft² (276 g/m²), Coating Designation G-90.
- B. Material for pickets shall be 1" square x 14 Ga. tubing. The rails shall be steel channel, 1.75" x 1.75" x .105". Picket holes in the rail shall be spaced 4.715" o.c. Fence posts and gate posts shall meet the minimum size requirements of Table 1.

2.3 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Section 033000 "Cast-in-Place Concrete" with a minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch maximum aggregate size.
- C. Grounding Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.
 1. Bonding Jumpers: Braided copper tape, 1 inch wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.

2.4 DECORATIVE METALLIC-COATED STEEL TUBULAR PICKET FENCES

- A. Decorative Metallic-Coated Steel Tubular Picket Fences: Comply with ASTM F 2408, for light industrial (commercial) application (class) unless otherwise indicated.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Ameristar Fence Products; Montage II standard picket space with All Terrain Flexibility, Genesis design, 3-Rail, extended picket bottom rail treatment or equal.
- B. Metallic-Coated Steel Sheet: Galvanized-steel sheet or aluminum-zinc alloy-coated steel sheet.
- C. Posts:
 1. End and Corner Posts: Square tubes 3 by 3 inches formed from 12 ga nominal-thickness, metallic-coated steel sheet and hot-dip galvanized after fabrication.
 2. Fence and gate posts as scheduled below:
 - 3.

Table 1 – Minimum Sizes for Montage II Posts			
Fence Posts	Panel Height		
2-1/2" x 12 Ga.	Up to & Including 6' Height		
3" x 12 Ga.	Over 6' Up to & Including 8' Height		
Gate Leaf	Gate Height		
	Up to & Including 4'	Over 4' Up to & Including 6'	Over 6' Up to & Including 8'
Up to 4'	2-1/2" x 12 Ga.	3" x 12 Ga.	3" x 12 Ga.

4'1" to 6'	3" x 12Ga.	4" x 11 Ga.	4" x 11 Ga.
6'1" to 8'	3" x 12 Ga.	4" x 11 Ga.	6" x 3/16"
8'1" to 10'	4" x 11 Ga.	6" x 3/16"	6" x 3/16"
10'1" to 12'	4" x 11 Ga.	6" x 3/16"	6" x 3/16"
12'1" to 14'	4" x 11 Ga.	6" x 3/16"	6" x 3/16"
14'1" to 16'	6" x 3/16"	6" x 3/16"	6" x 3/16"

- D. Post Caps: Aluminum castings.
- E. Rails: Square tubes.
- F. Pickets: Square tubes.
 - 1. Extend pickets beyond top rail as indicated and terminate with galvanized-steel caps.
 - 2. Picket Spacing: 4.715 inches on center, maximum.
- G. Fasteners: Manufacturer's standard concealed fastening system.
- H. Galvanizing: For components indicated to be galvanized and for which galvanized coating is not specified in ASTM F 2408, hot-dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.
- I. Finish: The manufactured panels and posts shall be subjected to an inline electrode position coating (E-Coat) process consisting of a multi-stage pretreatment/wash (with zinc phosphate), followed by a duplex application of an epoxy primer and an acrylic topcoat. The minimum cumulative coating thickness of epoxy and acrylic shall be 2 mils (0.058 mm). The color shall be **[black]**. The coated panels and posts shall be capable of meeting the coating performance criteria of ASTM F2408.
- J. Swing gates shall be fabricated using 1.75" x 14ga Forerunner double channel rail, 2" sq. x 11ga. gate ends, and 1" sq. x 14ga. pickets. Gates that exceed 6' in width will have a 1.75" sq. x 14ga. intermediate upright. All rail and upright intersections shall be joined by welding. All picket and rail intersections shall also be joined by welding. Gusset plates will be welded at each upright to rail intersection. Provide cable kits for additional trussing for all gates leaves over 6'.
- K. Rolling Gates: Ameristar PassPort Commercial Ornamental design series and Genesis style and 3-rail frame configuration.
 - 1. Ornamental picket material shall be 1" square x 14 Ga. tubing for PassPort® Commercial Ornamental gate pickets. Picket spacing shall be 4-5/8" for PassPort® Commercial Ornamental gate pickets. Material for top rails, uprights and diagonals rails shall be 2" square x 11 Ga. Material for the bottom rail shall be 2" x 4" x 11 Ga. Posts shall be 4" square x 11 Ga.
 - 2. Pickets, rails, uprights and posts shall be precut to specified lengths. Diagonals shall be precut to specified lengths and angles. Frame materials shall be joined by welding. Pickets shall be face welded to roll gate frame, except for Invincible style gates over 18' long. Invincible style gates over 18' long shall have pickets face-welded to 2" x 2" angle iron to form panels equal in length to the gate frame bay width.
- L. General: Comply with Section 087100 "Door and Gate Hardware" and drawings for gate hardware.

2.5 KNOX BOX LOCK

A. MANUFACTURER:

1. Provide Knox Company, www.knoxbox.com/, or equal.
- B. SERIES
 1. Frame or masonry wall conditions: Series 3200 Recessed Mounting, UL Listed, powder coat finish, color as selected by Architect.
 2. Fence panel conditions: Series 3200 Surface Mounting, UL Listed, powder coat finish, color as selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.
 1. Construction layout and field engineering are specified in Section 017300 "Execution."

3.3 DECORATIVE FENCE INSTALLATION

- A. Install fences according to manufacturer's written instructions.
- B. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 36 inches or as designated on drawings, most stringent applies.
- C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 2. Concrete Fill: Place concrete around posts and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
 - a. Exposed Concrete: Extend 2 inches above grade. Finish and slope top surface to drain water away from post.
 3. Posts Set in Concrete: Extend post to within 6 inches of specified excavation depth, but not closer than 3 inches to bottom of concrete.
 4. Space posts uniformly at 8 feet o.c.

3.4 DECORATIVE GATE INSTALLATION

- A. Gate posts shall be spaced according to the manufacturers' gate drawings, dependent on standard out-to-out gate leaf dimensions and gate hardware selected. Type and quantity of gate hinges shall be based on the application; weight, height, and number of gate cycles. The manufacturers' gate drawings shall identify the necessary gate hardware required for the application. Gate hardware shall be provided by the manufacture of the gate and shall be

installed per manufacturer's recommendations. Provide surface mounted Knox Box at gates located across fire lane.

3.5 CLEANING

- A. The contractor shall clean the jobsite of excess materials; post-hole excavations shall be scattered uniformly away from posts.

END OF SECTION 323119

SECTION 323300 - SITE FURNISHINGS

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. Bicycle racks.
 - 2. Bicycle storage.
 - 3. Precast seat walls.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawing
 - 1. Show in-place location, fabrication details, plans, elevations, anchorages, reinforcement, connection details and methods, dimensions, finishes, relationships to adjacent materials, and erection and placement.
- C. Samples: Nominal size 6" sq. by appropriate thickness, of each type of unit and finished facing shown and specified for approval of quality, color, and texture of surface finish. Submit prior to fabrication.
- D. Mix Design(s): Proposed concrete mix design for each type and color of concrete mix.
- E. Test Reports: Compressive Strength. Supply 12 test results from the last year showing the required results of 5000 PSI.

1.4 QUALITY ASSURANCE

- A. Fabricator's Qualifications: Firm shall have a minimum of fifteen (15) years experience in producing units similar to those required for this Project, with sufficient production capacity to produce and deliver required units without causing delay in Work.
- B. Has a quality control program that is comparable to APA or PCI that is certified by a professional engineer. Must submit program with bid.
- C. Fabricator must manufacture product within 120 miles of project site.
- D. Must have a qualified sales person located within 50 miles of the project site.
- E. Test architectural precast concrete in accordance with ACI 533.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver units to the Project site in such quantities and at such times to ensure continuity of installation.
- B. Deliver on a truck owned by the manufacturer. Truck to have a crane or a forklift for placement. Driver to be trained to use applicable equipment. Placement where possible. Contractor to place product not reachable by manufacturer's equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Dero Bike Rack Co.
 - 2. ULINE.
 - 3. Treetop Products.
 - 4. Or Equal.

2.2 BICYCLE RACKS EXTERIOR

- A. Products: Subject to compliance with requirements, provide the following or equal to Dero Bike Rack Co.; Model RR5H, 111 inches length, 11 bike capacity.
- B. Bicycle Rack Construction:
 - 1. Frame: Galvanized steel.
 - 2. Installation Method: In ground mount (IG).

2.3 BICYCLE RACKS INTERIOR

- A. Products: Subject to compliance with requirements, provide the following or equal to Dero Bike Rack Co.; Model Wall Rack, 18 inches length, 2 bike capacity.
- B. Bicycle Rack Construction:
 - 1. Frame: 1 inch 11 gauge tube.
 - 2. Finish: Black rubber dip.
 - 3. Installation Method: Wall mounted.

2.4 BICYCLE STORAGE

- A. Products: Subject to compliance with requirements, provide the following or equal to Dero Bike Rack Co. Model Dero Sigle Locker
- B. Bicycle Rack Construction:
 - 1. Frame: 14 gauge tube, 18gauge plate floor, top and side, 16gauge door
 - 2. Finish: galvanized, power coated.
 - 3. Installation Method: Floor mounted.

2.5 PRECAST SEAT WALLS

- A. Precast Seat Walls:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Quick Crete Products Corp.
 - b. Dura Art Stone.
 - c. Stone Caster Studio.
 - d. Or Equal.
- B. Concrete Materials:
 - 1. Portland Cement: ASTM C 150, Type I(white) or III (gray), to achieve desired finish colors. Use only one brand, type, and color from the same mill.
 - 2. Aggregates: ASTM C 33, gradation may differ to achieve desired finish characteristics. Select coarse and fine aggregate colors and screen sizes to match approved sample(s). Verify that adequate supply, from one pit or quarry, for each type of aggregate is

available for the entire Project. If possible obtain entire aggregate supply prior to starting Work, or have aggregate supply held in reserve by aggregate supplier.

3. Water: Potable. Clean, clear, and free from deleterious amounts of salts, acids, alkali's, organic materials, oils, detergents, or other matter that may interfere with color, curing, or strength of concrete.
4. Admixtures: Select to be compatible in specified mix.
 - a. Air Entraining: ASTM C 260.
 - b. Water Reducing: ASTM C 494, Type A,B,C,F. or G.
 - c. Coloring Agent: ASTM C 979, compatible with other concrete materials.

C. Formwork:

1. Provide forms with acceptable form facing materials that are non-reactive with concrete or form release agents and will produce required finish surfaces.
2. Construct and maintain forms to produce precast concrete units of shapes, lines, and dimensions indicated, within specified tolerances.

D. Reinforcing Materials: Reinforcing Bars: ASTM A 615, Grade 40.

2.6 MIXES

- A. Design mixes for each type of concrete specified may be prepared by an independent testing agency or by architectural precast manufacturing plant personnel at precast fabricator's option.
- B. Proportion mixes by either testing agency trial batch or field test data methods in accordance with ACI 211.1, using materials to be used on the project, to provide normal weight concrete with properties as follows:
 1. Compressive Strength: 5,000 psi when tested in accordance with ASTM C 39.
 2. Maximum water cement ratio 0.47 at point of placement.
 3. Add air-entrainment admixture to result in air content at point of placement complying with ACI 533 requirements.
 4. List other admixtures and recommended quantities.

2.7 FABRICATION

- A. General:
 1. Fabricate precast concrete units with manufacturing and testing procedures, quality control recommendations, and dimensional tolerances as specified in ACI 533, unless more stringent requirements are shown or specified.
 2. Fabricate units straight, smooth and true to size and shape, with exposed edges and corners precise and square, unless otherwise indicated.
- B. Reinforcement: Comply with CRSI "Manual of Standard Practice" and ACI 318 recommendations. Reinforce architectural precast concrete units to resist handling, transportation stresses, and to comply with specified performance criteria.
- C. Comply with ACI-533 requirements for measuring, mixing, transporting, and placing concrete.
- D. Consolidate concrete using equipment and procedures complying with ACI 533.
- E. Discard units that are warped, cracked, broken, spalled, stained, or otherwise defective unless repairs are approved by the Owner and meet specified requirements.
- F. Fabrication Tolerances: Fabricate to tolerances listed in ACI-533.

2.8 FINISHES

- A. Finish exposed surfaces:
 - 1. Color: French Gray.
 - 2. Texture: Craftman's Etch.
 - 3. Surface finish free from pockets, sand streaks, honeycomb, with uniform color and texture. Bugholes less than 1/4 inch in diameter are acceptable only on heavier blasted finishes. Bugholes not acceptable on smooth, light sandblast or acid etch finishes.
- B. Seam lines to be stoned neatly to minimize appearance. Products with wide seam lines could be subject to rejection.

2.9 SEALERS

- A. A. All surfaces to be sealed with three coats, standard gloss, of a water based acrylic sealer, which has graffiti-resistant qualities. Must be non-sacrificial so most graffiti can be cleaned with lacquer thinner and not require resealing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.
- B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.
- C. Install site furnishings level, plumb, true, and securely anchored at locations indicated on Drawings.
- D. Defective Work: Discard units that do not conform to requirements as shown or specified. Replace with units which meet requirements.

END OF SECTION 323300

**SECTION 32 84 00
LANDSCAPE IRRIGATION**

PART 1 GENERAL

1.01 SUMMARY

- A. It is the intent of the specifications and drawings that the finished system is complete in every respect and shall be ready for operation satisfactory to the **Owner**.
- B. The work shall include all materials, labor, services, transportation, and equipment necessary to perform the work as indicated on the drawings, in these specifications, and as necessary to complete the contract.

1.02 CONSTRUCTION DRAWINGS

- A. Due to the scale of the drawings, it is not possible to indicate all offsets, fittings, sleeves, etc. which may be required. The Contractor shall carefully investigate the structural and finished conditions affecting all of his work and plan his work accordingly, furnishing such fittings, etc. as may be required to meet such conditions. Drawings are generally diagrammatic and indicative of the work to be installed. The work shall be installed in such a manner as to avoid conflicts between irrigation systems, planting, and architectural features.
- B. All work called for on the drawings by notes or details shall be furnished and installed whether or not specifically mentioned in the specifications. When an item is shown on the plans but not shown on the specifications or vice versa, it shall be deemed to be as shown on both. The Landscape Architect shall have final authority for clarification.
- C. The Contractor shall not willfully install the irrigation system as shown on the drawings when it is obvious in the field that obstructions, grade differences or discrepancies in area dimensions exist that might not have been considered in engineering. Such obstructions or differences should be brought to the attention of the Landscape Architect as soon as detected. In the event this notification is not performed, the Irrigation Contractor shall assume full responsibility for any revision necessary.

1.03 QUALITY ASSURANCE

- A. Provide at least one English speaking person who shall be present at all times during execution of this portion of the work and who shall be thoroughly familiar with the type of materials being installed and the manufacturer's recommended methods of installation and who shall direct all work performed under this section.
- B. Manufacturer's directions and detailed drawings shall be followed in all cases where the manufacturer of articles used in this contract furnish directions covering points not shown in the drawings and specifications.
- C. All local, municipal, and state laws, rules and regulations governing or relating to any portion of this work are hereby incorporated into and made a part of these specifications, and their provisions shall be carried out by the Contractor. Anything contained in these specifications shall not be construed to conflict with any of the above rules and regulations of the same. However, when these specifications and drawings call for or describe materials, workmanship, or construction of a better quality, higher standard, or larger size than is required by the above rules and regulations, the provisions of these specifications and drawings shall take precedence.

- D. All materials supplied for this project shall be new and free from any defects. All defective materials shall be replaced immediately at no additional cost to **Owner**.
- E. The Contractor shall secure the required licenses and permits including payments of charges and fees, give required notices to public authorities, verify permits secured or arrangements made by others affecting the work of this section.
- F. The contractor shall employ only Landscape Industry Certified Technicians registered with the California Landscape Contractors Association (CLCA), as foreman for irrigation installation work on this project.
- G. Contractor shall submit to the Landscape Architect within 30 days of notice to proceed, photocopies of current Landscape Industry Certified Technician registration for foreman performing work on this project. Submit a resume of the foreman's experience on projects of similar size & scope to this project.**

1.04 SUBMITTALS

A. Submittals Materials List:

1. After award of contract and before any irrigation system materials are ordered from suppliers or delivered to the job site, submit to the **Owner** a complete list of all irrigation system materials, or processes proposed to be furnished and installed as part of this contract.
2. The submittals materials list shall include the following information (no exceptions):
 - a. A title sheet with the job name, the contractor's name, contractor's address and telephone number, submittal date and submittal number.
 - b. An index sheet showing the item number (i.e. 1,2,3, etc.); an item description (i.e. sprinkler head); the manufacturer's name (i.e. Hunter Industries); the item model number (i.e. I-40-ADV/36V); and the page(s) in the submittal set that contain the catalog cuts.
 - c. The catalog cuts shall be one or two pages copied from the **most recent** manufacturer's catalog that indicate the product submitted. Do not submit parts lists, exploded diagrams, price lists or other extra information.
 - d. The catalog cuts shall clearly indicate the manufacturer's name and the item model number. The item model number, all specified options and specified sizes shall be circled on the catalog cuts.
 - e. Submittals for equipment indicated on the legend without manufacturer names, or "as approved", shall contain the manufacturer, Class or Schedule, ASTM numbers and/or other certifications as indicated in these specifications.
3. Submittal materials list format requirements:
 - a. **Submittals shall be provided as one complete package for the project. Multiple partial submittals will not be reviewed.**
 - b. Submittal package shall be stapled or bound in such a way as to allow for disassembly for review processing. Submittals shall not have tabs, tab sheets, spiral binding, or any other type of binding that will interfere with automated copying of submittals.

- c. Submittal package shall have all pages numbered in the lower right hand corner. Page numbers shall correspond with submittal index.
 - d. Re-submitted packages must be revised to include only the equipment being re-submitted. Equipment previously reviewed and accepted shall not be re-submitted in the materials list/index sheet or in the catalog cut sheet package.
- B. Substitutions: If the Irrigation Contractor wishes to substitute any equipment or materials for those equipment or materials listed on the irrigation drawings and specifications, he may do so by providing the following information to the Landscape Architect or Owner's authorized representative for approval.
 - 1. Provide a written statement indicating the reason for making the substitution.
 - 2. Provide catalog cut sheets, technical data, and performance information for each substitute item.
 - 3. Provide in writing the difference in installed price if the item is accepted.
- C. The Landscape Architect or Owner's authorized representative will allow no substitutions without prior written acceptance.
- D. Manufacturer's warranties shall not relieve the Contractor of his liability under the guarantee. Such warranties shall only supplement the guarantee.
- E. The Landscape Architect or Owner's authorized representative will not review the submittal package unless provided in the format described above.

1.05 EXISTING CONDITIONS

- A. The Contractor shall verify and be familiar with the locations, size and detail of points of connection provided as the source of water, electrical supply, and telephone line connection to the irrigation system.
- B. Irrigation design is based on the available static water pressure shown on the drawings. Contractor shall verify static water on the project prior to the start of construction. Should a discrepancy exist, notify the Landscape Architect and Owner's authorized representative prior to beginning construction.
- C. Prior to cutting into the soil, the Contractor shall locate all cables, conduits, sewer septic tanks, and other utilities as are commonly encountered underground and he shall take proper precautions not to damage or disturb such improvements. If a conflict exists between such obstacles and the proposed work, the Contractor shall promptly notify the Landscape Architect and Owner who will arrange for relocations. The Contractor will proceed in the same manner if a rock layer or any other such conditions are encountered.
- D. The Contractor shall protect all existing utilities and features to remain on and adjacent to the project site during construction. Contractor shall repair, at his own cost; all damage resulting from his operations or negligence.

- E. The Irrigation Contractor shall coordinate with the General Contractor for installation of required sleeving as shown on the plans prior to paving operations.
- F. The Contractor shall verify and be familiar with the existing irrigation systems in areas adjacent to and within the Project area of work.
- G. The Contractor shall protect all existing irrigation systems, in areas adjacent to and within the project area of work, from damage due to his operations.
- H. Contractor shall notify Owner's Representative if any existing system is temporarily shut off, capped or modified. Provide 48-hour notice, prior to turning off or modifying any existing irrigation system.
- I. The Contractor shall repair or replace all existing irrigation systems, in areas adjacent to and within the project area of work, damaged by the construction of this project. Adjacent irrigation systems shall be made completely operational and provide complete coverage of the existing landscaped areas. All repairs shall be complete to the satisfaction of the Owner's Representative.
- J. The contractor shall provide bore holes under any existing pavement or paving encountered for the required lateral, mainline and low voltage control wire sleeving. Bore holes under 2 inches in diameter and smaller shall be made with a BulletMole® underground boring tool as manufactured by Dimension Tools, LLC (Contact telephone number (888)-650-5554 or at www.bulletmole.com). Bore holes larger than 2 inches in diameter shall be made with an approved mechanical boring tool. No air jacking or hydraulic boring of any kind shall be allowed.

1.06 INSPECTIONS

- A. The Contractor shall permit the Landscape Architect and Owner's authorized representative to visit and inspect at all times any part of the work and shall provide safe access for such visits.
- B. Where the specifications require work to be tested by the Contractor, it shall not be covered over until accepted by the Landscape Architect, Owner's authorized representative, and/or governing agencies. The Contractor shall be solely responsible for notifying the Landscape Architect, Owner, and governing agencies, a minimum of 48 hours in advance, where and when the work is ready for testing. Should any work be covered without testing or acceptance, it shall be, if so ordered, uncovered at the Contractor's expense.
- C. Inspections will be required for the following at a minimum:**
 - 1. Pre-construction meeting.
 - 2. System layout.
 - 3. Pressure test of irrigation mainline (Four hours at 125 PSI or 120% of static water pressure, whichever is greater.) Mainline pressure loss during test shall not exceed 2 PSI.
 - 4. Coverage test of irrigation system. Test shall be performed prior to any planting.
 - 5. Final inspection prior to start of maintenance period.
 - 6. Final acceptance prior to turnover.

- D. Site observations and testing will not commence without the field record drawings as prepared by the Irrigation Contractor. Record drawings must complete and up to date for each site visit.
- E. Work that fails testing and is not accepted will be retested. Hourly rates and expenses of the Landscape Architect, **Owner's** authorized representative, and governing agencies for re-inspection or retesting will be paid by the Irrigation Contractor at no additional expense to **Owner**.

1.07 STORAGE AND HANDLING

- A. Use all means necessary to protect irrigation system materials before, during, and after installation and to protect the installation work and materials of all other trades. In the event of damage, immediately make all repairs and replacements necessary to the acceptance of the Landscape Architect and **Owner** and at no additional cost to the **Owner**.
- B. Exercise care in handling, loading, unloading, and storing plastic pipe and fittings under cover until ready to install. Transport plastic pipe only on a vehicle with a bed long enough to allow the pipe to lay flat to avoid undue bending and concentrated external load.

1.08 CLEANUP AND DISPOSAL

- A. Dispose of waste, trash, and debris in accordance with applicable laws and ordinances and as prescribed by authorities having jurisdiction. Bury no such waste material and debris on the site. Burning of trash and debris will not be permitted. The Contractor shall remove and dispose of rubbish and debris generated by his work and workmen at frequent intervals or when ordered to do so by the **Owner's** authorized representative.
- B. At the time of completion the entire site will be cleared of tools, equipment, rubbish and debris which shall be disposed of off-site in a legal disposal area.

1.09 TURNOVER ITEMS

- A. Record Drawings:
 - 1. Record accurately on one set of drawings all changes in the work constituting departures from the original contract drawings and the actual final installed locations of all required components as shown below.
 - 2. The record drawings shall be prepared to the satisfaction of the **Owner**. Prior to final inspection of work, submit record drawings to the Landscape Architect or **Owner's** authorized representative.
 - 3. All record drawings shall be prepared using AutoCAD 2010 drafting software and the original irrigation drawings as a base. No manual drafted record drawings shall be acceptable. The Contractor may obtain digital base files from the Landscape Architect or **Owner's** authorized representative.
 - 4. If the Contractor is unable to provide the AutoCAD drafting necessary for the record drawings the irrigation designer does provide record drawing drafting as a separate service.
 - 5. Prior to final inspection of work, submit record drawings plotted onto vellum sheets for review by the Landscape Architect or **Owner's** authorized representative. After acceptance by the Landscape Architect, City Inspector or **Owner's** authorized representative re-plot the record drawings onto reproducible Mylar sheets. The Contractor shall also provide record drawing

information on a digital AutoCAD Release 2010 drawing file. All digital files shall be provided on a compact disc (CD) clearly marked with the project name, file descriptions and date.

- a. Record drawing information and dimensions shall be collected on a day-to-day basis during the installation of the pressure mainline to fully indicate all routing locations and pipe depths. Locations for all other irrigation equipment shall be collected prior to the final inspection of the work.
 - b. Two dimensions from two permanent points of reference such as buildings, sidewalks, curbs, streetlights, hydrants, etc. shall be shown for each piece of irrigation equipment shown below. Where multiple components are installed with no reasonable reference point between the components, dimensioning may be made to the irrigation equipment. All irrigation symbols shall be clearly shown matching the irrigation legend for the drawings. All lettering on the record drawings shall be minimum 1/8 inch in size.
6. Show locations and depths of the following items:
- a. Point of connection (including water POC, backflow devices, master control valves, flow sensors, etc.)
 - b. Routing of sprinkler pressure main lines (dimensions shown at a maximum of 100 feet along routing)
 - c. Isolation valves
 - d. Automatic remote control valves (indicate station number and size)
 - e. Quick coupling valves
 - f. Drip air relief and flush valves
 - g. Routing of control wires where separate from irrigation mainline
 - h. Irrigation controllers (indicate controller number and station count)
 - i. Related equipment (as may be directed)

B. Controller Charts:

1. Provide one controller chart for each automatic controller. Chart shall show the area covered by the particular controller. The areas covered by the individual control valves shall be indicated using colored highlighter pens. A minimum of six individual colors shall be used for the controller chart unless less than six control valves are indicated.
2. Landscape Architect or Owner's authorized representative must approve record drawings before controller charts are prepared.
3. The chart is to be a reduced copy of the actual "record" drawing. In the event the controller sequence is not legible when the drawing is reduced, it shall be enlarged to a readable size.
4. When completed and approved, the chart shall be hermetically sealed between two pieces of plastic, each piece being a minimum 20 mils in thickness.

C. Operation and Maintenance Manuals:

1. Two individually bound copies of operation and maintenance manuals shall be delivered to the Landscape Architect or **Owner's** authorized representative at least 10 calendar days prior to final inspection. The manuals shall describe the material installed and the proper operation of the system.
2. Each complete, bound manual shall include the following information:
3. Index sheet stating Contractor's address and telephone number, duration of guarantee period, list of equipment including names and addresses of local manufacturer representatives.
 - a. Operating and maintenance instructions for all equipment.
 - b. Spare parts lists and related manufacturer information for all equipment.

D. Equipment:

1. Supply as a part of this contract the following items:
 - a. Two (2) wrenches for disassembly and adjustment of each type of sprinkler head used in the irrigation system.
 - b. Three 30-inch sprinkler keys for manual operation of control valves.
 - c. Two keys for each automatic controller.
 - d. Two quick coupler keys with a **3/4"** bronze hose bib, bent nose type with hand wheel and two coupler lid keys.
 - e. One valve box cover key or wrench.
 - f. Six extra sprinkler heads of each size and type.
 - g. For specified ball valves if required: One (1) 5-foot long valve handle, to fit the specified ball valves.
2. The above equipment shall be turned over to **Owner's** authorized representative at the final inspection.

1.10 COMPLETION

- A. At the time of the pre-maintenance period inspection, the Landscape Architect, **Owner's** authorized representative, and governing agencies will inspect the work, and if not accepted, will prepare a list of items to be completed by the Contractor. Punch list to be checked off by contractor and submitted to Landscape Architect or **Owner's** Authorized representative prior to any follow-up meeting. This checked off list to indicate that all punch list items have been completed. At the time of the post-maintenance period or final inspection the work will be re-inspected and final acceptance will be in writing by the Landscape Architect, **Owner's** authorized representative, and governing agencies.

- B. The **Owner's** authorized representative shall have final authority on all portions of the work.
- C. After the system has been completed, the Contractor shall instruct **Owner's** authorized representative in the operation and maintenance of the irrigation system and shall furnish a complete set of operating and maintenance instructions.
- D. Any settling of trenches which may occur during the one-year period following acceptance shall be repaired to the **Owner's** satisfaction by the Contractor without any additional expense to the **Owner**. Repairs shall include the complete restoration of all damage to planting, paving or other improvements of any kind as a result of the work.

1.11 GUARANTEE

- A. The entire sprinkler system, including all work done under this contract, shall be unconditionally guaranteed against all defects and fault of material and workmanship, including settling of backfilled areas below grade, for a period of one (1) year following the filing of the Notice of Completion.
- B. Should any problem with the irrigation system be discovered within the guarantee period, it shall be corrected by the Contractor at no additional expense to **Owner** within ten (10) calendar days of receipt of written notice from **Owner**. When the nature of the repairs as determined by the **Owner** constitute an emergency (i.e. broken pressure line) the **Owner** may proceed to make repairs at the Contractor's expense. Any and all damages to existing improvement resulting either from faulty materials or workmanship, or from the necessary repairs to correct same, shall be repaired to the satisfaction of the **Owner** by the Contractor, all at no additional cost to the **Owner**.
- C. Guarantee shall be submitted on Contractors own letterhead as follows:

GUARANTEE FOR SPRINKLER IRRIGATION SYSTEM

We hereby guarantee that the sprinkler irrigation system we have furnished and installed is free from defects in materials and workmanship, and the work has been completed in accordance with the drawings and specifications, ordinary wear and tear and unusual abuse, or neglect excepted. We agree to repair or replace any defective material during the period of one year from date of filing of the Notice of Completion and also to repair or replace any damage resulting from the repairing or replacing of such defects at no additional cost to the **Owner**. We shall make such repairs or replacements within 10 calendar days following written notification by the **Owner**. In the event of our failure to make such repairs or replacements within the time specified after receipt of written notice from **Owner**, we authorize the **Owner** to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefore upon demand.

PROJECT NAME:

PROJECT LOCATION:

CONTRACTOR NAME:

ADDRESS:

TELEPHONE:

SIGNED:

DATE:

PART 2 MATERIALS

2.01 SUMMARY

Use only new materials of the manufacturer, size and type shown on the drawings and specifications. Materials or equipment installed or furnished that do not meet Landscape Architect's, **Owner's**, or governing agencies standards will be rejected and shall be removed from the site at no expense to the **Owner**.

2.02 PIPE

- A. Pressure supply line between the water meter and the backflow prevention device shall be type K copper, one size larger than backflow device.
- B. Backflow prevention assemblies, and all other above grade assemblies, shall be constructed of threaded brass pipe and threaded brass fittings the same size as the backflow device, unless otherwise directed.
- C. Pressure supply lines 1 1/2 inches in diameter and smaller downstream of the backflow prevention unit shall be Schedule 40 solvent weld PVC conforming to ASTM D1785.
- D. Pressure supply lines 2 inches in diameter and up to 3 inches in diameter downstream of backflow prevention unit shall be Class 315 solvent weld PVC. Piping shall conform to ASTM D2241.
- E. Pressure supply lines 4 inches in diameter and larger downstream of the backflow unit shall be Class 200 bell and gasket PVC conforming to ASTM 2672.
- F. Non-pressure lines 3/4 inch in diameter and larger downstream of the remote control valve shall be Class 200 solvent weld PVC conforming to ASTM D2672.
- G. Non-pressure lines 3/4 inch in diameter and larger downstream of the remote control valve shall be SCH 40 solvent weld PVC conforming to ASTM D1785.
- H. On grade non-pressure lines 3/4 inch in diameter and larger downstream of the remote control valve shall be Schedule.40 UV resistant solvent weld PVC conforming to ASTM D1785.
- I. Recycled water PVC pipe to be color-coded purple in color marked on two sides with recycled water warning statements "Caution-Recycled Water". Recycled water piping must be accepted by the local recycled water governing agencies.

2.03 METAL PIPE AND FITTINGS

- A. Brass pipe shall be 85 percent red brass, ANSI, IPS Standard 125 pounds, Schedule 40 screwed pipe.
- B. Fittings shall be medium brass, screwed 125-pound class.
- C. Copper pipe and fittings shall be Type "K" sweat soldered, or brazed as indicated on the drawings.

2.04 PLASTIC PIPE AND FITTINGS

- A. Pipe shall be marked continuously with manufacturer's name, nominal pipe size, schedule or class, PVC type and grade, National Sanitation Foundation approval, Commercial Standards designation, and date of extrusion.
- B. All plastic pipe shall be extruded of an improved PVC virgin pipe compound in accordance with ASTM D2672, ASTM D2241 or ASTM D1785.
- C. All solvent weld PVC fittings shall be standard weight Schedule 40 (and Schedule 80 where specified on the irrigation detail sheet, all mainline fittings shall be Schedule 80 PVC) and shall be injection molded of an improved virgin PVC fitting compound. Slip PVC fittings shall be the "deep socket" bracketed type. Threaded plastic fittings shall be injection molded. All tees and ells shall be side gated. All fittings shall conform to ASTM D2464 and ASTM D2466.
- D. All threaded nipples shall be standard weight Schedule 80 with molded threads and shall conform to ASTM D1785.
- E. All solvent cementing of plastic pipe and fittings shall be a two-step process, using primer and solvent cement applied per the manufacturer's recommendations. Cement shall be of a fluid consistency, not gel-like or ropy. Solvent cementing shall be in conformance with ASTM D2564 and ASTM D2855.
- F. When connection is plastic to metal, female adapters shall be hand tightened, plus one turn with a strap wrench. Joint compound shall be non-lead base Teflon paste, tape, or equal.
- G. All pressure mainlines installed with solvent weld PVC fittings shall be installed with concrete thrust blocking at all directional changes in the mainline routing. Concrete thrust blocking shall not be required when ductile iron fittings and mechanical restraints are specified.
- H. PVC fittings used with UVR pipe shall be Schedule 40 UVR PVC type.

2.05 VALVES

- A. Gate Valves:
 - 1. Gate valves shall be of the manufacturer, size, and type indicated on the drawings.
 - 2. Gate valves shall be constructed of a bronze body, gate and stem. Gate valves shall have threaded connections.
 - 3. All gate valves shall have a minimum working pressure of not less than 150 PSI and shall conform to AWWA standards.
- B. Ball Valves:
 - 1. Ball valves shall be of the manufacturer, size, and type indicated on the drawings.
 - 2. Ball valves shall be constructed of a bronze or stainless steel body, stainless steel ball and stem. Ball valves shall have threaded connections.

3. All ball valves shall have a minimum working pressure of not less than 150 PSI and shall conform to AWWA standards.

C. Butterfly Valves:

1. Butterfly valves shall be of the manufacturer, size, and type indicated on the drawings.
2. Butterfly valves shall have cast iron bodies, and stainless steel stems. Butterfly valves shall have ductile iron porcelain enamel coated disc.
3. All Butterfly valves shall have a minimum working pressure of not less than 150 PSI and shall conform to AWWA standards.

D. Quick Coupler Valves:

1. Quick coupler valves shall be of the manufacturer, size, and type indicated on the drawings.
2. Quick coupler valves shall be brass with a wall thickness guaranteed to withstand normal working pressure of 150 psi without leakage. Valves shall have 1" female threads opening at base, with two-piece body. Valves to be operated only with a coupler key, designed for that purpose. Coupler key is inserted into valve and a positive, watertight connection shall be made between the coupler key and valve.
3. Vinyl quick coupler cover to be purple in color with the words "Warning-Recycled Water-Do Not Drink" permanently marked on lid.

E. Automatic Control Valves:

1. Automatic control valves shall be of the manufacturer, size, and type indicated on the drawings.
2. Automatic control valves shall be electrically operated.
3. Provide Christy's valve ID tags for each remote control valve with valve number.

2.06 VALVE BOXES

- A. Valve boxes shall be fabricated from a durable, weather-resistant plastic material resistant to sunlight and chemical action of soils.
- B. The valve box cover shall be **green** in color and secured with a hidden latch mechanism or bolts.
- C. The cover and box shall be capable of sustaining a load of 1,500 pounds.
- D. Valve box extensions shall be by the same manufacturer as the valve box.
- E. The plastic irrigation valve box cover shall be an overlapping type.

- F. Automatic control valve, master valve, flow sensor, and gate/ball valve boxes shall be 17"x11"x12" 'nominal' rectangular size. Valve box covers shall be marked "RCV" with the valve identification number, or "MV", "FS", "GV", "BV" "heat branded" onto the cover in 1-1/4 inch high letters / numbers.
- G. Drip flush valve and Air relief valve boxes shall be 6" circular size. Valve box covers shall be marked with "FV" or "ARV" "heat branded" onto the cover in 1-1/4 inch high letters.
- H. Quick coupler valve boxes shall be 10" circular size. Valve box covers shall be marked with "QCV" "heat branded" onto the cover in 1-1/4 inch high letters.
- I. Valve box cover shall be green in color and permanently marked (attached tags are not acceptable) on valve box cover plate with the words "Warning-Recycled Water-Do Not Drink".

2.07 AUTOMATIC CONTROLLER

- A. Automatic controller shall be of the manufacturer, size, and type indicated on the drawings.
- B. Controller enclosure shall be of the manufacturer, size, and type indicated on the drawings.
- C. Controller shall be grounded according to local codes using equipment of the manufacturer, size, and type indicated on the drawings; or as required by local codes and ordinances.

2.08 ELECTRICAL

- A. All electrical equipment shall be NEMA Type 3, waterproofed for exterior installations.
- B. All electrical work shall conform to local codes and ordinances.

2.09 LOW VOLTAGE CONTROL WIRING

- A. Remote control wire shall be direct-burial AWG-UF type, size as indicated on the drawings, and in no case smaller than 14 gauge.
- B. Connections shall of the manufacturer, size, and type indicated on the drawings.
- C. Common wires shall be white in color. Control wires shall be red (where two or more controllers are used, the control wires shall be a different color for each controller. These colors shall be noted on the "Record Drawings" plans located on controller door).
- D. Ground wires shall be green in color or bare copper and in no case smaller than 6 gauge.

2.10 IRRIGATION HEADS AND DRIP EMITTERS AND INLINE DRIP TUBING

- A. Irrigation heads, drip emitters and inline drip tubing shall be of the manufacturer, size, type, with radius of throw, operating pressure, and discharge rate indicated on the drawings.
- B. Irrigation heads, drip emitters and inline drip tubing shall be used as indicated on the drawings.
- C. Irrigation heads shall have purple recycled water warning cover.

2.11 DRIP IRRIGATION EQUIPMENT

Drip tubing equipment such as flush valves, air relief valves, wye strainers and pressure regulators shall be of the manufacturer, size, and type indicated on the drawings.

2.12 MISCELLANEOUS EQUIPMENT

A. Landscape Fabric:

1. Landscape fabric for valve box assemblies shall be 5.0- oz. weight woven polypropylene weed barrier. Landscape fabric shall have a burst strength of 225 PSI, a puncture strength of 60 lbs. and capable of water flow of 12 gallons per minute per square foot.
2. Type: DeWitt Pro 5 Weed Barrier or approved equal.

B. Equipment such as flow sensors, rain sensors, freeze sensors, flush valves, air relief valves, wye strainers, and master valves shall be of the manufacturer, size and type indicated on the drawings.

PART 3 EXECUTION

3.01 SITE CONDITIONS

A. Inspections:

1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
2. Verify that irrigation system may be installed in strict accordance with all pertinent codes and regulations, the original design, the referenced standards, and the manufacturer's recommendations.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Landscape Architect or **Owner's** authorized representative.
2. Do not proceed with installation in areas of discrepancy until all discrepancies have been resolved.

C. Grades:

1. Before starting work, carefully check all grades to determine that work may safely proceed, keeping within the specified material depths with respect to finish grade.

2. Final grades shall be accepted by the Engineer before work on this section will be allowed to begin.

D. Field Measurements:

1. Make all necessary measurements in the field to ensure precise fit of items in accordance with the original design. Contractor shall coordinate the installation of all irrigation materials with all other work.
2. All scaled dimensions are approximate. The Contractor shall check and verify all size dimensions prior to proceeding with work under this section.
3. Exercise extreme care in excavating and working near existing utilities. Contractor shall be responsible for damages to utilities, which are caused by his operations or neglect.

E. Diagrammatic Intent:

The drawings are essentially diagrammatic. The size and location of equipment and fixtures are drawn to scale where possible. Provide offsets in piping and changes in equipment locations as necessary to conform with structures and to avoid obstructions or conflicts with other work at no additional expense to **Owner**.

F. Layout:

1. Prior to installation, the Contractor shall stake out all pressure supply lines, routing and location of sprinkler heads, valves, **backflow preventer**, and automatic controller.
2. Layout irrigation system and make minor adjustments required due to differences between site and drawings. Where piping is shown on drawings under paved areas, but running parallel and adjacent to planted areas, install the piping in the planted areas.

G. Water Supply:

Connections to, or the installation of, the water supply shall be at the locations shown on the drawings. Minor changes caused by actual site conditions shall be made at no additional expense to **Owner**.

H. Electrical Service:

1. Connections to the electrical supply shall be at the locations shown on the drawings. Minor changes caused by actual site conditions shall be made at no additional expense to **Owner**.
2. Contractor shall make electrical connections to the irrigation controller. Electrical power source to controller locations shall be provided by others.

3. Contractor shall make electrical connections to the irrigation controller. 230-volt single-phase electrical power source to pump assembly location shall be provided by others per NEC codes.

3.02 TRENCHING

- A. Excavations shall be straight with vertical sides, even grade, and support pipe continuously on bottom of trench. Trenching excavation shall follow layout indicated on drawings to the depths below finished grade and as noted. Where lines occur under paved area, these dimensions shall be considered below subgrade.
- B. Provide minimum cover of 18 inches on pressure supply lines 2 ½ inches and smaller.
- C. Provide minimum cover of 24 inches on pressure supply lines 3 inches and larger.
- D. Provide minimum cover of 18 inches for control wires within planters.
- E. Provide minimum cover of 24 inches for control wires within sleeves below paving.
- F. Provide minimum cover of 36 inches on pressure supply lines under vehicular travel ways.
- G. Provide minimum cover of 12 inches for non-pressure lines.
- H. Pipes installed in a common trench shall have a 4-inch minimum space between pipes.

3.03 BACKFILLING

- A. Backfill material on all lines shall be the same as adjacent soil free of debris, litter, and rocks over 1/2 inches in diameter.
- B. Backfill shall be tamped in 4-inch layers under the pipe and uniformly on both sides for the full width of the trench and the full length of the pipe. Backfill materials shall be sufficiently damp to permit thorough compaction, free of voids. Backfill shall be compacted to dry density equal to adjacent undisturbed soil and shall conform to adjacent grades.
- C. Flooding in lieu of tamping is not allowed.
- D. Under no circumstances shall truck wheels be used to compact backfill.
- E. Provide sand backfill a minimum of 4 inches over and under all piping under paved areas.

3.04 PIPING

- A. Piping under existing pavement may be installed by jacking, boring, or hydraulic driving. No hydraulic driving is permitted under asphalt pavement.
- B. Cutting or breaking of existing pavement is not permitted.
- C. Carefully inspect all pipe and fittings before installation, removing dirt, scale, burrs, and reaming. Install pipe with all markings up for visual inspection and verification.
- D. Remove all dented and damaged pipe sections.

- E. All lines shall have a minimum clearance of 4 inches from each other and 12 inches from lines of other trades.
- F. Parallel lines shall not be installed directly over each other.
- G. In solvent welding, use only the specified primer and solvent cement and make all joints in strict accordance with the manufacturer's recommended methods including wiping all excess solvent from each weld. Allow solvent welds at least 15 minutes setup time before moving or handling and 24 hours curing time before filling.
- H. PVC pipe shall be installed in a manner, which will provide for expansion and contraction as recommended by the pipe manufacturer.
- I. Center load all plastic pipe prior to pressure testing.
- J. All threaded plastic-to-plastic connections shall be assembled using Teflon tape or Teflon paste.
- K. For plastic-to-metal connections, work the metal connections first. Use a non-hardening pipe dope on all threaded plastic-to-metal connections, except where noted otherwise. All plastic-to-metal connections shall be made with plastic female adapters.

3.05 CONTROLLER

- A. The exact location of the controller shall be approved by the Landscape Architect or **Owner's** authorized representative before installation. The electrical service shall be coordinated with this location.
- B. The Irrigation Contractor shall be responsible for the final electrical hook up to the irrigation controller.
- C. The irrigation system shall be programmed to operate during the periods of minimal use of the design area.

3.06 CONTROL WIRING

- A. Low voltage control wiring shall occupy the same trench and shall be installed along the same route as the pressure supply lines whenever possible.
- B. Where more than one wire is placed in a trench, the wiring shall be taped together in a bundle at intervals of 10 feet. Bundle shall be secured to the mainline with tape at intervals of 20 feet.
- C. All connections shall be of an approved type and shall occur in a valve box. Provide an 18-inch service loop at each connection.
- D. An expansion loop of 12 inches shall be provided at each wire connection and/or directional change, and one of 24 inches shall be provided at each remote control valve.
- E. A continuous run of wire shall be used between a controller and each remote control valve. Under no circumstances shall splices be used without prior approval.

3.07 VALVES

- A. Automatic control valves, quick coupler, and **gate** valves are to be installed in the approximate locations indicated on the drawings.
- B. Valve shall be installed in shrub areas whenever possible.
- C. Install all valves as indicated in the detail drawings.
- D. Valves to be installed in valve boxes shall be installed one valve per box.
- E. Provide valve ID tags for each remote control valve with valve number.

3.08 VALVE BOXES

- A. Valve boxes shall be installed in shrub areas whenever possible.
- B. Each valve box shall be installed on a foundation of 3/4 inch gravel backfill, 3 cubic feet minimum. Valve boxes shall be installed with their tops 1/2 inch above the surface of surrounding finish grade in lawn areas and 2 inches above finish grade in ground cover areas.

3.09 IRRIGATION HEADS **DRIP EMITTERS AND INLINE DRIP TUBING**

- A. Irrigation heads, **drip emitters and inline drip tubing** shall be installed as indicated on the drawings.
- B. Spacing of heads and inline drip tubing shall not exceed maximum indicated on the drawings.
- C. Riser nipples shall be of the same size as the riser opening in the sprinkler body.

3.10 MISCELLANEOUS EQUIPMENT

- A. Install all assemblies specified herein according to the respective detail drawings or specifications, using best standard practices.
- B. Quick coupler valves shall be set approximately 18 inches from walks, curbs, header boards, or paved areas where applicable.
- C. Install devices such as rain sensors, freeze sensors, flush valves, and air relief valves, master valves and flow sensors as indicated on the drawings and as recommended by the manufacturer.

3.11 FLUSHING THE SYSTEM

- A. Prior to installation of irrigation heads, the valves shall be opened and a full head of water used to flush out the lines and risers.
- B. Irrigation heads shall be installed after flushing the system has been completed.

3.12 ADJUSTING THE SYSTEM

- A. Contractor shall adjust valves, align heads, and check the coverage of each system prior to coverage test.

- B. If it is determined by the Landscape Architect or **Owner's** authorized representative that additional adjustments or nozzle changes will be required to provide proper coverage, all necessary changes or adjustments shall be made prior to any planting.
- C. The entire system shall be operating properly before any planting operations commence.
- D. Automatic control valves are to be adjusted so that the irrigation heads, **drip emitters and inline drip tubing** operate at the pressure recommended by the manufacturer.

3.13 TESTING AND OBSERVATION

- A. Do not allow or cause any of the work of this section to be covered up or enclosed until it has been observed, tested and accepted by the Landscape Architect, **Owner**, and governing agencies.
- B. The Contractor shall be solely responsible for notifying the Landscape Architect, **Owner**, and governing agencies, a minimum of 48 hours in advance, where and when the work is ready for testing.
- C. When the sprinkler system is completed, the Contractor shall perform a **coverage test** of each system in its entirety to determine if the water coverage for the planted areas is complete and adequate in the presence of the Landscape Architect.
- D. The Contractor shall furnish all materials and perform all work required to correct any inadequacies of coverage due to deviations from the plans, or where the system has been willfully installed as indicated on the drawings when it is obviously inadequate, without bringing this to the attention of the Landscape Architect. This test shall be accepted by the Landscape Architect and accomplished before starting any planting.
- E. Areas to be maintained for the formal maintenance period shall start maintenance at the same time, as directed by the Landscape Architect, **Owner**, and governing agencies. Partial areas will not be released into maintenance prior to completion of items listed in the pre-maintenance review. The maintenance period may not be phased.
- F. If, after the maintenance review, the irrigation systems are not accepted by the Landscape Architect, the contractor shall reimburse the Architect for additional site visits, or additional time required to review work. All additional time will be billed at the Architect's hourly rate and will be paid for by the contractor at no additional cost to the owner.
- G. Final inspection will not commence without record drawings as prepared by the Irrigation Contractor.

3.14 MAINTENANCE

During the maintenance period the Contractor shall adjust and maintain the irrigation system in a fully operational condition providing complete irrigation coverage to all intended plantings.

3.15 COMPLETION CLEANING

Clean up shall be made as each portion of the work progresses. Refuse and excess dirt shall be removed from the site, all walks and paving shall be swept, and any damage sustained on the work of others shall be repaired to original conditions.

END OF SECTION

SECTION 329113 - SOIL PREPARATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. The General Conditions of the contract apply to the work of this section the same as though written herein.

1.2 SCOPE OF WORK

- A. Furnish labor, materials, and equipment to place imported topsoil and prepare soil for planting, and to finish grade as described herein and upon the drawings.
- B. Work not included: Rough grading and storm drainage

1.3 RELATED SECTIONS

- A. Section 32 84 00 – Planting Irrigation
- B. Section 32 92 23 – Sodding

1.4 REFERENCES

- A. American Society for Testing and Materials (ASTM)
- B. American Association of State Highway and Transportation Officials (AASHTO)
- C. Standard Specifications for Public Works Construction, latest edition (Greenbook)

1.5 SUBMITTALS

- A. Product Submittals – Submit samples and literature under provisions of Section 01 33 00 or Section 01 25 00 (or applicable Product Substitution section). Partial or incomplete submittals are considered not acceptable and will be returned without a review.
 - 1. Organic soil amendments – Submit samples and product specifications not more than 30 days old. Specification shall include particle size evaluation, total nitrogen (N), ammonia (NH₄-N, nitrate (NO₃-N), ECe, pH, micro nutrients, and metals.
 - 2. Inorganic conditioners, fertilizers, and chemicals – Submit product literature and specifications.
 - 3. Import Topsoil– Submit sample and product analysis.
 - 4. Agricultural Soil Tests – Submit analysis report and recommendations for soil samples.
- B. Certifications – Submit copies of Landscape Industry Certified Technician registration for foremen performing work on this project.

- C. Costs for sampling, testing or inspection of materials are included in bid, and copies of inspections, certificates, and tests results shall be furnished without additional cost to the Owner.
- D. Substitutions – For materials that differ from a specified brand or product, submit samples, product specifications, and product literature. Follow procedures as prescribed under Division 1.

1.6 EXPERIENCE AND QUALIFICATIONS

- A. The Contractor shall employ Landscape Industry Certified Technicians with the California Landscape Contractors Association (CLCA), as foremen for landscape installation work.

1.7 RESPONSIBILITY

- A. The Contractor shall be responsible for the protection of public and private property adjacent to the work, and shall exercise due caution to avoid damage to such property. The work shall be protected and maintained throughout the contract period, including during suspension of work, and until final acceptance of the work. Contractor shall repair or replace damaged improvements including acts of vandalism, theft, and graffiti removal. Repairs or replacements shall be at least equal to original condition of the existing improvement, and shall match in finish and dimension.
- B. Prior to starting the work of this Section, verify that previously installed work is complete to the point where this installation may properly commence. Verify that work of this Section may be installed in accordance with the design, pertinent codes, regulations, and portions of the referenced standards.
- C. In the event of discrepancy, immediately notify the Landscape Architect.
- D. Do not proceed with installation in areas of discrepancy until such discrepancies have been fully resolved.

PART 2 - PRODUCTS

2.1 SOIL AMENDMENTS

- A. Organic Soil Conditioner- Humic Compost
 - 1. Product shall be fully composted 100 percent recycled organic product, consisting of composted bio-solids and aged wood fiber with particles passing a ½ inch screen. Product shall be non-hazardous, and conform to U.S. EPA 40 CFR 503 criteria for class “A” product. Manufactured by Agri-Service, Oceanside, CA.
- B. Humate Plus
 - 1. A commercially mined and packaged soil conditioner containing 40 percent organic matter, 40 percent Carbon, and 40 percent humic acids. Manufactured by Tri- C Enterprises, Chino, CA, (800) 927-3311.

2.2 AGRICULTURAL GYPSUM

- A. A commercially processed and packaged product with a minimum 90 percent Calcium Sulfate dihydrate ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) and minimum 14 percent Sulfur (S). Gypsum shall be free flowing,

fine granular form with 100 percent passing a 10 mesh screen. Product shall be environmentally safe and produced specifically for agricultural or landscape use.

B. Granular Fertilizer

1. Fertilizer shall be “Gro Power Plus 5-3-1 w/M”, no known equal.
2. Fertilizer shall be delivered to the site in original unopened containers bearing the manufacturer’s guaranteed analysis. Wet or caked fertilizer is not acceptable.

C. EZ Wet 26% Sprayable Soil Penetrant

1. A commercially produced organic bio-degradable neutral PH soil penetrant packaged in liquid form.

D. Refer to section 32 93 00 Plants for additional soil amendments used at planting pits including fertilizer tablets and mycorrhizal innoculum.

2.3 PRE-EMERGENT HERBICIDES

- A. Pre-emergent herbicides shall be a wettable powder or granule type product, suitable for use with the groundcovers specified on the plans and suitable for use with the on-site soil.
- B. Herbicides shall be selected for controlling the weeds indigenous to the site.
- C. Herbicides shall comply with requirements of local and state agencies having jurisdiction over the project.
- D. Submit product literature for review and approval prior to use.

2.4 AMENDMENTS FOR BID

- A. Quantity and procedure adjustments may be requested by the Landscape Architect, after reviewing of the Agricultural Soil Analysis report. Adjustments by the Landscape Architect will issued in writing. The following amendments and quantities are to be used as the basis for bids:

1. Soil amendments for planting areas with gradient less than 2:1 in slope. Quantity per 1,000 square feet:

4 cu. yds.	Organic soil conditioner
50 lbs.	Humate Plus
150 lbs	Granular Fertilizer (GroPower Plus fertilizer w/ M)
50 lbs.	Agricultural gypsum
8 oz.	EZ Wet (in 12 gallons of water)

2. Soil amendments for 2:1 slopes. Quantities per 1000 square feet:

1/3 cu. yds. Organic soil conditioner

150 lbs GroPower Plus Fertilizer Controlled Release (3-4 month)

8 oz EZ Wet soil penetrant

3. Refer to Section 32 93 00 Plants for bid amendments for plant pit backfill mix.

2.5 IMPORTED TOPSOIL

- A. Imported topsoil shall be 70/30 Topsoil manufactured by Agri Service, Oceanside, CA, unless otherwise noted on plans. Provide soil free of subsoil, brush, objectionable weeds, seeds, rocks, organic or inorganic debris, silt, and clay, toxic substance, organic or inorganic; soil sterilants; salts; and soil removed from road bed excavations.
- B. The Contractor shall furnish upon the request of the Landscape Architect a soils report made from the intended import by an approved agricultural lab. The report shall include pH, N-P-K, SAR, minerals, micro-nutrients, ECe, boron levels, soil particle size, and textural evaluation. Soil imported to site and found to be unsuitable by the Landscape Architect shall be removed from the site and replaced with an approved soil at the Contractor's expense. The Contractor shall pay expenses for soil testing of import materials.

PART 3 - EXECUTION

3.1 GENERAL

- A. Planting operations shall not commence until completion of construction work, grading, soil preparation, weed control, and sprinkler installation.
- B. Irrigation system shall be fully operational including automatic controller, before commencing planting operations.

3.2 AGRICULTURAL SOIL TESTING

- A. The Contractor is responsible for correction of soil pH, nutrient levels, and chemical balance until final acceptance by the Owner.
- B. Soil samples shall be taken from three (3) separate locations chosen by the installing contractor and submitted to a soil analysis laboratory. Separate results shall be provided for each of the 3 samples, with each having its own individual letter or number to identify it. Include with the samples, a description of the proposed planting, a reduced scale site plan showing where each sample was taken with its letter or number shown, and the type of organic amendment to be used.
- C. The analysis report shall include pH, N-P-K, SAR, ECe, boron levels, percolation rates, and soil particle size and textural evaluation (% of sand/silt/clay). The report shall include recommendations for amendments, fertilizers, application rates, and procedures for conditioning the soil.
- D. The Landscape Architect shall review the analysis reports prior to ordering amendments.

E. Soils testing shall be done by one of the following:

1. Wallace Laboratories, 365 Coral Circle, El Segundo, CA 90245, 310-615-0116
2. Waypoint Analytical, 4741 E. Hunter Ave, Suite A, Anaheim, CA 92807, 714-282-8777.

3.3 PERCOLATION TESTS

- A. Test for percolation prior to sending soil sample to analysis laboratory.
- B. Auger eight (8) holes four (4) feet deep at locations determined by the Landscape Architect. Fill holes with water to one half the depth of each hole. Let drain.
- C. Once holes have drained, fill holes again to one half the depth of each hole.
- D. Record drop in water level at thirty (30) minute intervals for maximum of six hours (6) or until the water has percolated.
- E. Submit monitoring results in a chart format to Landscape Architect for review. Each test location shall be shown on a reduced scale site plan with a letter or number identifying its location. The chart shall clearly indicate the total number of inches of percolation per test location over the six hour period. When the percolation rate is one (1) inch per hour or less, the Landscape Architect will request alternatives with cost for improving percolation and drainage of the planting area.

3.4 WEED ABATEMENT

- A. In areas designated to receive amendments, irrigate normally for two weeks to germinate weed seeds. Apply contact herbicide per manufacturer's instructions.
- B. Repeat the application of herbicide when weeds remain or new weeds appear one (1) week after initial application.
- C. Clear and grub dead weeds and organic debris prior to commencing topsoil placement or soil preparation.

3.5 IMPORT TOPSOIL PLACEMENT

- A. Refer to the Drawings for areas to receive, and the depth of topsoil.
- B. The import topsoil shall be placed in maximum 6 inch lifts with the first lift placed and tilled into the top 6 inches of the existing soil. Prior to placing each lift, the area shall be thoroughly moistened but not saturated. Each succeeding lift shall be placed and compacted to until the finished grades indicated on the drawings are achieved.
- C. The finished grades shall be free of depressions, humps, rocks, debris, air pockets, and ready to receive soil amendments.

3.6 SOIL PREPARATION

- A. In planting areas with a gradient less than 2:1, mechanically rip or hand till the area in two directions to a minimum depth of 8 inches.
- B. Remove rock and hard clods 2 inches in diameter and larger, remove construction debris, roots, stumps, trash and other deleterious materials from the top 6 inches of soil.
- C. Apply soil amendments, fertilizers, and conditioners evenly and at the specified application rates.
- D. Fine grade to contours and spot elevations shown on Drawings.

3.7 LANDSCAPE FINISH GRADING

- A. Finish grading shall establish flow lines and gradients for uniform water drainage. Flow lines and gradients shall be established from the high point to the drainage structure or outfall area. Finished grades shall be of uniform slope and grade between points of fixed elevations or elevation controls. Flow lines shall have a minimum 2 percent gradient from highpoint to inlet or outfall area. Contractor shall notify the Landscape Architect when grades or flow lines conflict with other construction or when positive drainage is not achievable and request a resolution. Failure to report the conflicts prior to planting shall result in removing the plant material, re-grading to correct the discrepancy and replacement of the plant material at no cost to the Owner.
- B. Unless noted otherwise, finished grades along walkways and curbs shall maintain a constant relationship between the finished paving and finished grade. Finished grade for lawn areas shall be 1 inch below sidewalks and curbs. Finished grades for mulch or ground cover areas shall be 2 inches below sidewalks and curbs.
- C. Finished grades shall be floated to a uniform surface free of irregular dips, humps, valleys or ridges. Refer to Section 32 92 23 for additional requirements for preparing lawn area, (if applicable)
- D. The finished grades shall maintain drainage away from buildings, structures, walls, paving, and towards drain inlets or outfall areas. Flow lines shall be established to drain water from behind walls and towards drain structures.
- E. When no compaction rate for planting areas is specified geotechnical report or when no report is available, compact turf and groundcover areas a minimum 85 percent to a maximum 90 percent relative density or as shown on drawings or specified elsewhere.

END OF SECTION 329113

SECTION 32 92 23 – SODDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. The General Conditions of the contract apply to the work of this section the same as though written herein.

1.2 RELATED REQUIREMENTS

- A. Furnish labor, materials, and equipment to provide, and install, and maintain soil preparation, headers, finish grading, and planting described herein and upon the drawings.
 - 1. Sod / Turfgrass
- B. Section 32 84 00 – Planting Irrigation
- C. Section 32 91 13 – Soil Preparation

1.3 REFERENCE STANDARDS

- A. The editions of the specifications and standards referenced herein, published by the following organizations, apply to the work only to the extent specified by the reference:
- B. American Standard for Nursery Stock
- C. American National Standards Institute (ANSI)

1.4 SUBMITTALS

- A. Submit samples and literature under provisions of Section 01 33 00 or Section 01 25 00 (or applicable Product Substitution section). Partial or incomplete submittals are considered not acceptable and will be returned without a review.
- B. Submit descriptive literature and specifications for the following:
 - 1. Sod Type – including brand name, grower/ supplier, and installation instructions.
 - 2. Fertilizer – pre-plant fertilizer as recommended by the sod grower.
- C. When called for by local governing jurisdictions, submit copies of inspections, certificates, and product testing results.
- D. Submit photocopies of Landscape Industry Certified Technician (LICT) certificate for the foremen overseeing the work on the project. Where no LICT certificate is available, submit a resume of the foremen on company letterhead outlining the foremen's experience with projects of similar type and size.
- E. Substitutions: For materials that differ from a specified brand or product, submit product literature and specifications. Follow provision outlined under Section 01 25 00 Substitutions.

1.5 QUALIFICATIONS AND EXPERIENCE

- A. The Contractor shall employ only Landscape Industry Certified Technicians (LICT) with the California Landscape Contractors Association (CLCA), as foremen for sod installation work.

1.6 PROJECT / SITE CONDITIONS

- A. Field Measurements: Each bidder is required to visit the site of the Work to verify the existing conditions. No adjustments will be made to the Contract Sum for variations in the existing conditions.
 - 1. Where turfgrass/sod is indicated to fit with other construction, verify dimensions of other construction by field measurements before proceeding with the work.
- B. Environmental Limitations:
 - 1. Do not install sod/turfgrass during rainy or extreme temperature conditions.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Do not expose materials to excessive moisture or other conditions that would adversely affect their serviceability.

1.8 RESPONSIBILITIES

- A. The Contractor shall be responsible for the protection of the work, and for public and private property adjacent to the work, and shall exercise due caution to avoid damage to such property. The work shall be protected and maintained throughout the contract period, including during suspension of work, and until final acceptance of the work. Contractor shall repair or replace damaged improvements including damages from acts of vandalism, theft, and graffiti removal. Repairs or replacements shall be at least equal to original condition of the improvements, and shall match in finish and dimension.
- B. Prior to work of this Section, verify that previously installed work is complete to the point where this installation may properly commence. Verify that work of this Section may be installed in accordance with the design, pertinent codes, regulations, and portions of the referenced standards.
- C. In the event of discrepancy, immediately notify the Architect.
- D. Do not proceed with installation in areas of discrepancy until such discrepancies have been fully resolved.

PART 2 - PRODUCTS

1.1 MATERIALS

A. SOD / TURFGRASS

1. Sod / Turfgrass shall be as indicated on the Drawings. Contractor shall verify with the supplier, that the sod type and quantity will be available at time of installation. Substitution will not be considered after acceptance of submittals.
2. Sod / Turfgrass shall be machine cut at a uniform soil thickness of 1/2 inch soil thickness. Individual pieces of sod shall be cut to the supplier's standard width and length. Maximum allowable deviation from standard width and lengths shall be 2 percent. Broken rolls or slabs and torn or uneven ends will not be acceptable. Standard size sections of sod shall be strong enough to support their own weight and retain their size and shape when suspended vertically from a firm grasp on the upper 10 percent of the section.
3. Sod / Turfgrass shall be harvested, delivered and installed within a period of 24 hours, unless a suitable preservation method is approved prior to delivery. Sod not installed within this period shall be reviewed prior to installation and accepted by the Architect. Sod shall not be harvested or transplanted when moisture content may adversely affect handling and installation.

2.2 SOIL AMENDMENTS AND CONDITIONERS

- A. Refer to Section 32 91 13 for specification of soil amendments, fertilizers and conditioners.

2.3 PRE-PLANT FERTILIZER

- A. Fertilizer shall be applied at 12 week intervals as follows:
 1. GroPower Premium High Nitrogen at 8 lbs/ 1,000 SF (December – February)
 2. GroPower Plus at 20 lbs/ 1,000 SF (March – November)

PART 3 - EXECUTION

3.1 GENERAL

- A. Planting operations shall not commence until completion of construction work, grading, soil preparation, weed control, and sprinkler installation.
- B. Irrigation system shall be fully operational including automatic controller, before commencing planting operations.
- C. Order sod to be cut and delivered only after finished grading and soil preparation have been accepted by the Architect.

3.2 INSTALLATION

- A. Prepare sod bed per Section 32 91 13 Soil Preparation.
- B. Smooth sod bed with a water-filled roller to eradicate air pockets of soft areas. Level and fine grade areas of depression and roll to firm up the soil.
- C. Water thoroughly to moisten soil to a minimum six (6) inches depth. Check area for settling and low areas, regrade and re-compact soil where settling occurs. Completed sod beds shall be reviewed by the Architect prior to installing sod.
- D. Prior to laying sod, broadcast fertilizer recommended by the grower at 2 pounds per 1,000 square feet and lightly rake into top ½ inch of finished grade.
- E. Unroll sod in same direction each time. Sod shall be laid in a straight line and in a staggered pattern, free of gaps or voids between rows. Ends shall be slightly tucked under and butted tight against the previous roll to provide a seamless appearance. Cut rolls as necessary to fit, with no lengths shorter than 18 inches.
- F. Where installing on slopes, begin sod along the toe of slope and stagger each succeeding row. On slopes greater than 4:1, stake both ends of every roll with wooden pegs. When sod ends against an open bed of soil, mound the soil against the sod to keep the edges from drying.
- G. Roll sodded areas with a roller weighing approximately 16 pounds per lineal inch to compact the soil around the roots and provide a smooth, even mowing surface.
- H. Water sod with a fine mist spray within 30 minutes of laying. At the end of the day water thoroughly the entire area a depth of 4 inches. For the following 10 days, continue watering as needed to maintain a wet squishy texture. After the 10 days reduce the watering to a normal seasonal schedule.
- I. Protect sod areas from pedestrian traffic, vehicular traffic, and other construction work until acceptance of the areas by the Architect. Replace damaged sod with the same type and from the same source at no additional cost to the Owner.
- J. Dead, dying or damage sod shall be replaced at no additional cost to the Owner. Ruts, depressions, dips humps, skinned areas from mowing or other maintenance activities shall be repaired at no additional cost to the Owner.

END OF SECTION 329223

SECTION 32 93 00 - PLANTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. The General Conditions of the contract apply to the work of this section the same as though written herein.

1.2 SCOPE OF WORK

- A. Furnish labor, materials, and equipment to provide, and install and maintain trees, shrubs and groundcovers as described herein and upon the drawings.

1.3 RELATED SECTIONS

- A. Section 328400 – Landscape Irrigation
- B. Section 329113 – Soil Preparation
- C. Section 329453 – Landscape Barrier Membranes

1.4 REFERENCE AND STANDARDS

- A. American Standard for Nursery Stock – ANSI Z60.1 – 2004
- B. Sunset Western Garden Book – latest edition

1.5 SUBMITTALS

- A. Submittals shall conform to provisions of Division 1. Submittal package shall include all products and materials related to the work of this Section. Partial or incomplete submittals will not be accepted and will be returned without a review.
- B. Submit descriptive literature and specifications for the following:
 - 1. Plant material list of trees, shrubs, and groundcovers to be furnished; include name of supplier or nursery source.
 - 2. Weed abatement herbicides, product literature and specifications.
 - 3. Staking, tying, guying, and erosion control products.
 - 4. Fertilizers, conditioners, import topsoil, and backfill products.
 - 5. Organic and inorganic mulch.
 - 6. Pre-emergent herbicide.

- C. Contractor shall submit to the Landscape Architect within 30 days from notice to proceed, photocopies of current Landscape Industry Certified Technician registration for foremen performing work on this project.
- D. Submit photographs for each species of tree and for all shrubs and groundcovers. Photographs shall be of an individual plant with the size, shape and structure clearly defined. The size of the plant (height x width) and name of the source nursery shall be included with the plant photo. The plant material in the photo shall be a representative example of the entire quantity being supplied.

1.6 SUBSTITUTIONS

- A. Follow procedures as outline under Division 1.
- B. Products: When a brand name is called for on the Drawings or in these specifications, submit a letter describing the purpose for the substitution and include the product literature and specifications of the substitution.
- C. Plant Material: When a plant species is shown to be unavailable in the size or quantity specified, a substitution will be considered provided the substitute materials are reviewed and accepted through the submittal process. Except for the variations so authorized, substitute plant materials shall conform to the requirements of these specifications. If the accepted substitute materials are of less value than those indicated or specified, the contract price will be adjusted in accordance with the provisions of the contract.

1.7 QUALIFICATIONS AND EXPERIENCE

- A. The Contractor shall employ only Landscape Industry Certified Technicians registered with the California Landscape Contractors Association (CLCA), as foremen for planting installation work. Submit a resume of the foreman's experience on projects of similar size and scope to this project.
- B. Sampling, testing, or inspection costs of material required by local or state agencies are to be borne by the Contractor, and copies of inspection certificates shall be furnished without additional charge.

1.8 RESPONSIBILITY

- A. The Contractor shall be responsible for the protection of the work and the public and private property adjacent to the work and shall exercise due caution to avoid damage to such property. The work shall be protected and maintained throughout the contract period, including during suspension of work, and until final acceptance of the work. Contractor shall repair or replace damaged improvements including damages from acts of vandalism, theft, and graffiti removal. Repairs or replacements shall be at least equal to original condition of the existing improvement and shall match in finish and dimension.
- B. Prior to work of this Section, verify that previously installed work is complete to the point where this installation may properly commence. Verify that work of this Section may be installed in strict accordance with the original design, pertinent codes, regulations, and portions of the referenced standards.

- C. In the event of discrepancy, immediately notify the Landscape Architect.
- D. Do not proceed with installation in areas of discrepancy until such discrepancies have been fully resolved.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

- A. Nomenclature: Plant species' names shall be per the latest edition of Sunset Western Garden Book. Botanical names shall take precedence over common names.
- B. Plant material size and quality shall conform to standards established by American Standard for Nursery Stock, ANSI 260.1-2004, May 12, 2004 Edition.
- C. Conditions: Plants shall be symmetrical, typical for variety and species, sound, healthy, vigorous, free from plant disease, insect pests or their eggs, excessive abrasions or other objectionable disfigurements, and shall have healthy, normal root systems, well-filling their containers, but not to the point of being root bound. Tree trunks shall be sturdy and well hardened-off. Plants shall not be pruned prior to delivery except as authorized by the Architect.
- D. In no case shall trees or shrubs be topped or pruned within 6 months prior to delivery. Plants shall be grown by nurseries that have been inspected by the State Department of Agriculture and have complied with its regulations.
- E. Identification: Plants shall be of the variety and size shown on the drawings, and shall conform to the requirements herein. One of each bundle or lot shall be tagged with plant name in accordance with recommendations of the American Association of Nurserymen.
- F. Container plant inspection and rejection: root condition of container plants will be determined by the Architect through the removal of plant from the container of at least two plants but not more than 2 percent of the total number each species from each source.
- G. The Landscape Architect will inspect trees and shrubs upon delivery. Trees and shrubs will be rejected for the following characteristics:
 - 1. Enlarged cankers or galls at the base of the trunk, just above the soil level.
 - 2. Crooked trunks
 - 3. Scars or trunk damage, broken branches, etc.
 - 4. Asymmetrical branching
 - 5. Rootbound condition
 - 6. Trees that have been recently pruned
 - 7. Trees not matching in size and shape of the representative photograph sample

- H. Quantities: Quantities of plant material shall be furnished as needed to complete work as indicated on the drawings, including reseeding, replanting, and maintenance (replacements) during the contract period.
- I. Sizes and Caliper: Minimum height (above soil level), width (average diameter of dripline), and caliper (trees only, measured at 30 inches above the soil level) of plant materials shall be as shown in expanded plant materials legend on planting detail sheet.

2.2 EROSION CONTROL MATTING

- A. Slopes steeper than 2:1 shall be protected with jute erosion control matting, properly staked and tied at 4 feet on center, maximum.

2.3 TREE STAKES

- A. Tree stakes shall be a minimum 2 inches in diameter by 10 feet long new lodge pole pine treated.
- B. Tree stakes for tree-wells shall be 3 inches in diameter by 10 foot long galvanized steel pipe with threaded galvanized cap on top end.

2.4 TREE AND VINE TIES

- A. Tree ties shall be "Cinch-Tie CT32" as manufactured by V.I.T. Products, Escondido, CA (619) 480-6702, or approved equal.
- B. Use 36 inch long ties for 24 inch box and larger trees.
- C. 1 1/2 inch galvanized roofing nails to secure ties.
- D. Espalier to concrete or stucco surface: 7/8 inch diameter aluminum flat washer or clear plastic "button" with wire hook secured to surface with G.E. clear silicone rubber and 1/2 inch wide "Tye-All" tie.

2.5 TREE GUYING MATERIAL

- A. Anchors shall be Duckbill, Earth Anchor Systems, as manufactured by Forsight Products, Inc., or approved equal. Cable shall be non-coated, stainless steel braided cable, sized per manufacturer's recommendations.
- B. Anchor and cable sizing shall be per the following schedule:

<u>Tree Caliper</u>	<u>Anchor</u>	<u>Cable size</u>	<u>Rated Capacity</u>
Up to 3 inches	#40	1/16 inch	300 pounds
3 inches to 6 inches	#68	1/8 inch	1,100 pounds
6 inches to 11 inches	#88	3/16 inch	3,000 pounds

- C. Hose cable guards shall be new 5/8 inch rubber, brown or red.
- D. Cable sleeves shall be new 1/2 inch white Schedule 40 PVC pipe.
- E. Cable clamps shall be hot dip galvanized. Swedge fittings are not allowed, except at anchor.

2.6 BACKFILL AMENDMENTS

- A. Refer to Section 32 91 13 for specification of soil amendments and conditions.

2.7 IMPORT SOIL OR TOPSOIL

- A. Refer to Section 32 91 13 for specification.

2.8 PLANT PIT BACKFILL MATERIAL

- A. Backfill material for plant pits shall be a mixture as noted below or as indicated on drawings. The materials shall be thoroughly batch-mixed prior to placement so that they are evenly distributed and without clods or lumps. Backfill shall be so placed in the pits that the plant will be at its natural growing height after settlement. The following amendments and quantities shall be used as the basis for bids.

90 percent by volume Excavated soil, free from rocks, etc.

10 percent by volume Organic soil amendment

10 pounds Agricultural gypsum per cu. yd. of mix

8 pounds Humate Plus per cu. yd. of mix

16 pounds Gro-Power Plus Fertilizer per cu. yd. of mix

2.9 ORGANIC MULCH MATERIAL

- A. Shredded mulch shall consist of 100 percent recycled above ground tree products. Free of demolition wood waste, grass, weed seed, yucca, palm, bamboo, succulents or other contaminants. Mulch shall be nitrogen stabilized and shall contain no trash, hazardous waste, or toxic materials.
- B. Shredded wood mulch shall be "Forest Fines" mulch available from Agri Service, Inc., p. (800) 262-4167 or equal.
- C. Mulch shall be ground and screened to 2 inch minus particle size.
- D. Submit (1) 1-quart sample to the Landscape Architect for approval prior to installation.

2.10 INORGANIC MULCH MATERIAL

- A. Not applicable to this project.

2.11 PRE-EMERGENT HERBICIDE

- A. Pre-emergent herbicides shall be wettable powder or granular type.
- B. Select pre-emergent herbicide appropriate to site area, soil type, indigenous weeds to be controlled, and type of ground cover to be planted.
- C. Follow manufacturer's precautions and label instructions. Comply with local jurisdictional restrictions and ordinances.

2.12 FERTILIZER TABLETS

- A. Tablets shall be "Agriform" as manufactured by Sierra Industries.
- B. Agriform 21 gram tablets per part 3.3.E.

2.13 MYCORRHIZAL INOCULUM

- A. Shall be "Endo 120" granular as manufactured by Tri-C Enterprises, Chino, CA, (909) 590-1790.

PART 3 - EXECUTION

3.1 GENERAL

- A. Planting operations shall not commence until completion of construction work, grading, soil preparation, weed control, and sprinkler installation.
- B. Irrigation system shall be fully operational including automatic controller, before commencing planting operations.

3.2 SPACING OF PLANT MATERIAL

- A. When plant materials are shown or labeled in rows, the total length of the area shall be verified and the plants equally spaced within the area. When plant materials are shown in a random pattern, the material shall be equally spaced and placed to fill the area. Ground cover material shall be triangular or square spacing as indicated on the Drawings. When spacing is not shown, use triangular spacing.
- B. Trees and specimen shrubs shall be located with a wood stake or flag. The locations shall be reviewed and accepted by the Landscape Architect prior to planting.
- C. The work shown on the Drawings is schematic with trees, shrubs and groundcovers shown in their approximate locations. Contractor shall not locate any items where it is obvious that they are in direct permanent improvements, or pedestrian and vehicular safety considerations. Contractor shall not install plant materials in locations where the ultimate growth of the plant materials will damage or affect structures or impede pedestrian or vehicular circulation. Do not locate trees or taller shrubs in locations where they will block irrigation heads and prevent

adequate coverage. Where called for, obtain approval of the Landscape Architect for placement of trees, shrubs, and other items of work.

- D. Locate trees and taller shrubs 10 feet minimum away from rotor irrigation heads, 5 feet minimum from spray heads.

- E. Additional Tree Separation Distances:

<u>Description</u>	<u>Minimum Distance to Tree</u>
1. Traffic Signal/Stop Sign	20 feet
2. Underground Utility Lines	5 feet
3. Sewer Lines	10 feet
4. Above Ground Utility Structures (Transformers, Hydrants, Utility poles, etc.)	10 feet
5. Driveways	10 feet
6. Intersections (Intersecting curb lines of two streets)	25 feet

3.3 PLANT PITS AND PLANTING

- A. Plant pits shall be dug with level bottoms to widths and depths as shown on the Drawings. Pits for trees shall be dug square. Fill pits with water and allow to drain. All tree pits must meet the drainage requirement set forth in Section 32 91 13, Part 3.03, whether the area of the tree planting was tested for percolation or not. Notify Architect of any tree pit that does not meet the percolation test standard.
- B. Plant holes dug by auger method will be acceptable, but shall have side walls roughened or squared with a shovel. Slick pit walls caused by auguring in too wet soil will not be accepted for planting.
- C. Handling: no canned plant material shall be planted if the ball is broken or cracked either before or during the process of planting.
- D. Setting: plants shall be set with top of root ball 1 inch above finish grade. Each plant shall be placed in center of plant pit.
- E. Pit Backfilling
 - 1. Build mound of compacted backfill wide enough in bottom of hole to support root ball.
 - 2. Backfill pit with backfill mix half-way to finish grade and water thoroughly.

3. Place 21 gram plant tablets in plant pits, adhering to the following schedule:

Plant Tablet Schedule:

1 gallon	1	30 inch box	5
5 gallon	2	36 inch box	6
15 gallon	3	42 inch box	7
16 inch box	3	48 inch box	8
24 inch box	4		

4. Backfill to finish grade. Backfill mix shall be tamped lightly, and a shallow basin formed at perimeter of root ball to hold enough water to saturate the root ball and backfill mix.
5. Water immediately to saturate entire root ball and backfill.
6. Remove watering basin prior to hydroseeding (in turf areas only).
7. Apply Granular Mycorrhizal Inoculum per manufacturers instruction, at the following schedule:

1 gallon	1 tsp.
5 gallon	1 tbs.
15 gallon	3 tbs.
24 inch box	½ cup
36 inch box	1 cup
48 inch box	1 ½ cup

- F. Install tree root barriers per details shown on Drawings and Section 32 94 53.

3.4 TREE STAKING

- A. All trees (1-gallon through 36 inch box size) shall be staked as shown in planting details, no exceptions.
- B. Tree and stakes shall be vertical in all cases.
- C. One gallon trees shall be planted with nursery stakes removed.

3.5 TREE GUYING

- A. Trees 48 inch box size and larger may be required to be guyed depending on the field conditions (if a windy site). This will be determined in the field by the Landscape Architect after the trees have been installed.
- B. Guy 48 inch box and larger plant material with at least three guys in triangular pattern (see details). Wire shall be encased in new rubber hose where it comes in contact with tree. Locate loops on branches per details and so that cables do not chafe on each other or branches.
- C. Use only manufacturer-approved driving rods for installation of anchors. Set anchor, using method recommended by manufacturer appropriate for size anchor being driven.
- D. Guying requirement may be omitted by Landscape Architect when conditions permit.

3.6 APPLICATION OF PRE-EMERGENT HERBICIDE

- A. Apply pre-emergent herbicide to shrub and planted groundcover areas only. Do not apply to hydroseeded areas. Strictly adhere to manufacturer's specifications for application rates and methods.
- B. Apply pre-emergent only after planting operations have been completed so as to minimize disturbance of the chemical "barrier." Reapply where necessary to areas disturbed by planting or repair operations after initial application.
- C. Pay careful attention to activation requirements, "watering-in", etc., per manufacturer's specifications and label instructions. Avoid excessive irrigation run-off that would move or wash away the pre-emergent "barrier" -- use repeat watering cycles and split watering times.

3.7 ORGANIC & INORGANIC MULCHING

- A. After, planting operations are complete and shrubs areas have been raked and dressed, mulch shrub and ground cover areas with approved organic or inorganic mulch material as specified on drawings. Mulch layer depth shall be as described on drawings.
- B. Mulch layer should taper to zero at plant stem or tree trunk. Do not place mulch materials up against plant crown or trunk.
- C. Mulch flatted ground cover areas prior to planting ground cover, if called for on the drawings.

3.8 PROTECTION

- A. The Contractor shall carefully and continuously protect areas included in the contract, including lawn areas, plant material, supports, etc. until final acceptance of the work by the Owner or his representative.

3.9 CLEAN-UP

- A. After planting operations are completed, Contractor shall remove trash, excess soil, empty plant containers, or other accumulated debris from the site at no extra cost to Owner. Contractor shall repair scars, ruts, or mars in area caused by work operations. Areas shall be left in a neat and orderly condition daily.

3.10 OBSERVATIONS

- A. Contractor shall give forty-eight (48) hours notice and set appointment for reviews by the Architect.
- B. Reviews by Landscape Architect shall be scheduled for the following operations:
 - 1. Review of plant material after delivery to the site.
 - 2. Tree and shrubs placement/layout prior to digging holes.
 - 3. Review of groundcover lines and metal edging prior to planting.
 - 4. Start of establishment period/acceptance of installation.
 - 5. Refer to section 32 84 00-Landscape Irrigation for inspections and observations pertaining to irrigation scopes of work.
- C. Reviews shall be called for at the end of planting operations for the purpose of determining compliance with drawings and specifications, intent, workmanship, and clean-up. Contractor shall secure written verification of review data, any corrections required to work (punchlist corrections), and limits of reviewed area before beginning the described establishment work.
- D. In the event the Contractor requests inspection of work, and said work is substantially incomplete, the Contractor shall be responsible for Architect's hourly charges and per diem costs.

3.11 GUARANTEE

- A. Shrubs and ground covers shall be guaranteed as to growth and health for a period of 90 days after final acceptance by the Owner or his representative; 15 gallon and box sized trees shall be guaranteed for a period of 1 year after date of substantial completion.
- B. Plants which die or lose more than 30 percent of their original leaves shall be replaced under this section.

- C. The Contractor, within 14 days of written notification by the Owner, shall remove and replace guaranteed plant materials which for any reason fail to meet the requirements of the guarantee. Plants material replaced shall be guaranteed for the original period, starting from the date of replacement.

END OF SECTION - 329300

SECTION 329449 - TREE DRAINAGE SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The General Conditions of the contract apply to the work of this section the same as though written herein.

1.2 SCOPE OF WORK

- A. Furnish labor, materials, and equipment to provide, and install, plant pit breather tubes as described herein and upon the drawings.

1.3 RELATED SECTIONS

- A. Section 328400 – Planting Irrigation
- B. Section 329113 – Soil Preparation

1.4 REFERENCES

- A. The editions of the specifications and standards referenced herein, published by the following organizations, apply to the work only to the extent specified by the reference:
 - 1. American Society for Testing and Materials (ASTM)
 - 2. American National Standards Institute (ANSI)
 - 3. National Sanitation Foundation (NSF)

1.5 SUBMITTALS

- A. Submittals shall conform to provisions of Division 01. Partial or incomplete submittals are not acceptable and will be returned without a review.
- B. Submit descriptive literature and specifications for the following:
 - 1. PVC perforated drainpipe
 - 2. Connectors, fittings, glue, tape, and other accessories
 - 3. Grates
 - 4. Drain sock material
 - 5. Perforated flex pipe (edit if not using tree pit drain detail)

- C. Submit photocopies of current Certified Landscape Technician (CLT) certificate for foremen performing work on this project. When certificate is not available, submit a resume stating the foremen's experience with similar projects of the size and scope of work on this project.

1.6 QUALIFICATIONS AND EXPERIENCE

- A. The Contractor shall employ only Certified Landscape Technicians (CLT) with the California Landscape Contractors Association (CLCA), as foremen for landscape drainage installation work.

1.7 RESPONSIBILITY

- A. The Contractor shall be responsible for the protection of public and private property adjacent to the work, and shall exercise due caution to avoid damage to such property. The work shall be protected and maintained throughout the contract period, including during suspension of work, and until final acceptance of the work. Contractor shall repair or replace damaged improvements including damages from acts of vandalism, theft, and graffiti removal. Repairs or replacements shall be at least equal to original condition of the improvement, and shall match in finish and dimension.
- B. Prior to work of this Section, verify such previously installed work is complete to the point where this installation may properly commence. Verify that work of this section may be installed in accordance with the design, pertinent codes and regulations, and pertinent portions of the referenced standards.
- C. In the event of discrepancy, immediately notify the Architect.
- D. Do not proceed with installation in areas of discrepancy until such discrepancies have been fully resolved.

PART 2 - PRODUCTS

2.1 PLANT PIT BREATHER TUBES

- A. Tubes - rigid perforated polyvinyl chloride (PVC) drainpipe. Sizes per schedule on Drawings.
- B. Grate – NDS #14 round, flat polyethylene grates with UV inhibitor, black color, for 3" tube; NDS #11 round for 4" tube.
- C. Drain Sock – a non-woven geotextile filter fabric sleeve, sized to fit drainpipe specified.
- D. Other NDS fittings as required to complete the installation as shown on the drawings.

2.2 LANDSCAPE DRAINS

- A. Drains shall be as manufactured by NDS, Inc., (800) 726-1994, approved equal.

- B. Type 'A' Drain: NDS #78, 4 inch domed structural foam polyethylene atrium grate with UV inhibitor, black color, to fit 4 inch pipe riser installed by others.
- C. Type 'B' Drain: NDS # 1221 12 inch square adapter to fit 8 inch pipe riser installed by others. Grate shall be NDS # 1211 flat structural foam polyethylene grate with UV inhibitor, green color.
- D. Type 'C' Drain: NDS# 1221 12 inch square adapter to fit 8 inch pipe riser installed by others. Grate shall be NDS# 1290 domed structural foam polyethylene grate with UV inhibitor, black color.
- E. Other fittings or appurtenances required to complete the installation.
- F. All drain grates shall be secured to pipe or adapter with two stainless steel set screws.

2.3 TREE PIT DRAINS

- A. Breather tubes shall be per Part 2.01 above.
- B. Flex perforated pipe shall be manufactured by NDS or approved equal.
- C. Drain sock – a non-woven geotextile sleeve, size to fit drainpipe per detail.
- D. Other NDS fittings as required to complete the installation as shown on the drawings.

PART 3 - EXECUTION

3.1 PLANT PIT BREATHER TUBE INSTALLATION

- A. Install breather tubes per detail and schedule shown on the Drawings. Install tubes plumb and equally-spaced around the root ball.

3.2 DRAIN INSTALLATION

- A. Finish grading after soil preparation shall establish final flow lines and gradients for uniform water drainage. Flow lines and gradients shall be established from the high point to the drainage outlet or an inlet structure.
- B. Install landscape drains after finish grading has established final flow lines and swales. Cut pipe risers provided by others to proper height and install adapters and grates per detail drawings and manufacturer's instructions.

3.3 TREE PIT DRAIN INSTALLATION

- A. Install breather tubes plumb and equally spaced at edge of rootball.

- B. Install flex tube portion per detail in drawings. Slope only the portion of the pit beyond the rootball to achieve the required slope to the flex tube. The bottom of the plant pit below the rootball shall be level.
- C. Contractor shall coordinate the connection of the flex tube to the site drain lines with the appropriate contractor.

3.4 PROTECTION

- A. The Contractor shall carefully and continuously protect all areas included in the contract, including lawn areas, plant material, supports, etc. until final acceptance of the work by the Owner or his representative.
- B. Contractor shall verify positive drainage to all inlets after planting operations. Ponding of water in low spots and depressions in planting areas shall not be permitted.
- C. Contractor shall clear all obstructions from drain inlets and lines.

3.5 REVIEWS

- A. Contractor shall give 48 hours notice and set appointment for all reviews by the Architect.
- B. Review by Architect shall be scheduled for the following operations:
 - 1. Review of finish grading.
 - 2. Review placement of landscape drains.
 - 3. Review of finished grading.
- C. In the event the Contractor requests inspection of work, and said work is substantially incomplete, the Contractor shall be responsible for Architect's hourly charges and per diem costs.

3.6 CLEAN-UP

- A. Remove trash, excess soil, and other debris from the site. Repair scars, ruts, or mars in area caused by work operations.
- B. Clear obstructions from drain inlets and lines.

END OF SECTION - 329449

SECTION 329453 - TREE ROOT BARRIERS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. The General Conditions of the contract apply to the work of this section the same as though written herein.

1.2 SCOPE OF WORK

- A. Furnish labor, materials, and equipment to provide, and install root barriers as described herein and upon the Drawings.

1.3 RELATED SECTIONS

- A. Section 328400 – Planting Irrigation
- B. Section 329300 – Plants

1.4 REFERENCES

- A. The editions of the specifications and standards referenced herein, published by the following organizations, apply to the work only to the extent specified by the reference:
 - 1. American Society for Testing and Materials (ASTM)

1.5 SUBMITTALS

- A. Submit items specified following procedures prescribed under Section 01 33 00 Submittals. Partial or incomplete submittals are not acceptable and will be returned without a review.
- B. Submit description literature and specifications for the following:
 - 1. Tree root barrier
- C. Submit copies of Certified Landscape Technician (CLT) registration for foremen performing work on the project.
- D. Submit a minimum of five (5) projects with root barrier installed by the Contractor.

1.6 QUALIFICATIONS AND EXPERIENCE

- A. The Contractor shall employ only Certified Landscape Technicians (CLT) with the California Landscape Contractors Association (CLCA), as foremen for root barrier installation work.

- B. The Contractor shall show proof that personnel have at least five (5) years experience with installation of root barriers.

1.7 RESPONSIBILITY

- A. The Contractor shall be responsible for the protection of the work and for the public and private property adjacent to the work, and shall exercise due caution to avoid damage to such property. The work shall be protected and maintained throughout the contract period, including during suspension of work, and until final acceptance of the work. Contractor shall repair or replace damaged improvements including damages from acts of vandalism, theft, and graffiti removal. Repairs or replacements shall be at least equal to original condition of the existing improvement and shall match in finish and dimension.
- B. Prior to work of this Section, verify that previously installed work is complete to the point where this installation may properly commence. Verify that work of this section may be installed in strict accordance with the original design, pertinent codes, regulations and portions of the referenced standards.
- C. The contractor shall
- D. In the event of discrepancy, immediately notify the Architect.
- E. Do not proceed with installation in areas of discrepancy until such discrepancies have been fully resolved.

PART 2 - PRODUCTS

2.1 PLASTIC TREE ROOT BARRIERS

- A. The Contractor shall furnish and install tree root barriers as specified. The tree root barriers shall be product #UB 24-2 as manufactured by Deep Root Partners, LP, 345 Lorton Avenue #103, Burlingame, CA 94010, (800) 458-7668, or acceptable equal.
- B. The barriers shall be black, injection molded panels, of 0.085" wall thickness in modules 24 inches long by 24 inches deep; manufactured with a minimum 50% post-consumer recycled polypropylene plastic with added ultraviolet inhibitors; recyclable.
- C. Each panel shall have:
 - 1. Not less than four (4) molded integral vertical root deflecting ribs of a minimum 0.085" thickness protruding 1/2 inch at 90° from interior of the barrier panel, spaced 6" apart.
 - 2. A double top edge consisting of two parallel, integral, horizontal ridges of a minimum 0.085" thickness, 3/8" wide and 1/4" apart with the lower rib attached to the vertical root deflecting ribs.
 - 3. A minimum of 9 anti-lift ground lock tabs consisting of integral horizontal ridges of a minimum 0.085" thickness in the shape of a segment of a circle, the 2" chord of the segment joining the panel wall and the segment, protruding 3/8" from the panel. The nine ground

locks on each panel shall be about equally spaced between each of the vertical root deflecting ribs (3 between each set of ribs)

4. The basic properties of the copolymer polypropylene material shall be:

Test	ASTM Test Method	Value
Tensile stress @ yield	D638	3800 PSI
Elongation @ yield	D638	6.3%
Flexural Modulus	D790B	155,000 PSI
Notched Izod Impact	D256A	7.1
Rockwell Hardness R-scale	D785A	68

5. Preassembled self-locking flexible (0°-180°) joiner strips to connect one panel to the next.

PART 3 - EXECUTION

3.1 TREE ROOT BARRIER INSTALLATION

- A. Install the tree root barriers in a linear fashion adjacent to paving, sidewalk, or curb in conditions where trees are to be planted closer than 6 feet to these improvements. Root barriers shall extend 6 feet in each direction from center of tree as measured along length of improvement. Use only full panels.
- B. The vertical root deflecting ribs shall be facing inwards to the root ball and the double top edge shall be 1/2 inch above grade.
- C. Panels shall be connected with the flexible joiner strips in the length required.
- D. Omit barriers for palm trees, unless noted otherwise.

3.2 EXCAVATION AND BACKFILL

- A. Excavation and backfill shall conform to the manufacturer's specifications and details.
- B. At locations where root barriers are not adjacent to paving, sidewalks, or curbs, the barriers shall be backfilled on the outside with 3/4 inch to 1-1/2 inch gravel or crushed rock to the depth shown on the drawings.
- C. No gravel backfill is required for a linear installation.
- D. Barriers may be installed in same trench with irrigation lines.

END OF SECTION - 329453

SECTION 330500 - COMMON WORK RESULTS FOR UTILITIES

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. Piping joining materials.
 - 2. Transition fittings.
 - 3. Dielectric fittings.
 - 4. Sleeves.
 - 5. Identification devices.
 - 6. Grout.
 - 7. Flowable fill.
 - 8. Piped utility demolition.
 - 9. Piping system common requirements.
 - 10. Equipment installation common requirements.
 - 11. Painting.
 - 12. Concrete bases.
 - 13. Metal supports and anchorages.

1.3 DEFINITIONS

- A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.
- B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- C. ABS: Acrylonitrile-butadiene-styrene plastic.
- D. CPVC: Chlorinated polyvinyl chloride plastic.
- E. PE: Polyethylene plastic.
- F. PVC: Polyvinyl chloride plastic.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Dielectric fittings.
 - 2. Identification devices.

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.6 QUALITY ASSURANCE

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

- B. Steel Piping Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.8 COORDINATION

- A. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- B. Coordinate installation of identifying devices after completing covering and painting if devices are applied to surfaces.
- C. Coordinate size and location of concrete bases. Formwork, reinforcement, and concrete requirements are specified in Section 033000 "Cast-in-Place Concrete."

PART 2 - PRODUCTS

2.1 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness, unless otherwise indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAgl, silver alloy for refrigerant piping, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- G. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D 2235.
2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.

H. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.2 TRANSITION FITTINGS

- A. Transition Fittings, General: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
- B. Transition Couplings NPS 1-1/2 and Smaller:
 1. Underground Piping: Manufactured piping coupling or specified piping system fitting.
 2. Aboveground Piping: Specified piping system fitting.
- C. AWWA Transition Couplings NPS 2 and Larger:
 1. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.
- D. Plastic-to-Metal Transition Fittings:
 1. Description: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
- E. Plastic-to-Metal Transition Unions:
 1. Description: MSS SP-107, CPVC and PVC four-part union. Include brass threaded end, solvent-cement-joint plastic end, rubber O-ring, and union nut.
- F. Flexible Transition Couplings for Underground Nonpressure Drainage Piping:
 1. Description: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

2.3 DIELECTRIC FITTINGS

- A. Dielectric Fittings, General: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
- B. Dielectric Unions:
 1. Description: Factory fabricated, union, NPS 2 and smaller.
 - a. Pressure Rating: 150 psig **minimum** at 180 deg F.
 - b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded ferrous.
- C. Dielectric Flanges:
 1. Description: Factory-fabricated, bolted, companion-flange assembly, NPS 2-1/2 to NPS 4 and larger.
 - a. Pressure Rating: 150 psig **minimum**.
 - b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Kits:
 1. Description: Nonconducting materials for field assembly of companion flanges, NPS 2-1/2 and larger.

- a. Pressure Rating: 150 psig **minimum**.
 - b. Gasket: Neoprene or phenolic.
 - c. Bolt Sleeves: Phenolic or polyethylene.
 - d. Washers: Phenolic with steel backing washers.
 - E. Dielectric Couplings:
 - 1. Description: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining, NPS 3 and smaller.
 - a. Pressure Rating: 300 psig at 225 deg F.
 - b. End Connections: Threaded.
 - F. Dielectric Nipples:
 - 1. Description: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining.
 - a. Pressure Rating: 300 psig **at** 225 deg F
 - b. End Connections: Threaded or grooved.
- 2.4 SLEEVES
- A. Mechanical sleeve seals for pipe penetrations are specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
 - B. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
 - C. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, plain ends.
 - D. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
 - E. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.
 - F. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.
 - G. Molded PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- 2.5 IDENTIFICATION DEVICES
- A. General: Products specified are for applications referenced in other utilities Sections. If more than single type is specified for listed applications, selection is Installer's option.
 - B. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.
 - 1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
 - 2. Location: Accessible and visible.
 - C. Stencils: Standard stencils prepared with letter sizes complying with recommendations in ASME A13.1. Minimum letter height is 1-1/4 inches for ducts, and 3/4 inch for access door signs and similar operational instructions.
 - 1. Material: Brass.
 - 2. Stencil Paint: Exterior, oil-based, alkyd-gloss black enamel, unless otherwise indicated. Paint may be in pressurized spray-can form.
 - 3. Identification Paint: Exterior, oil-based, alkyd enamel in colors according to ASME A13.1, unless otherwise indicated.

- D. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.
- E. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure-sensitive-vinyl type with permanent adhesive.
- F. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers, extending 360 degrees around pipe at each location.
- G. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers, at least three times letter height and of length required for label.
- H. Lettering: Manufacturer's standard preprinted captions as selected by Architect.
- I. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least 3 mils thick.
 - 1. Width: 1-1/2 inches on pipes with OD, including insulation, less than 6 inches; 2-1/2 inches for larger pipes.
 - 2. Color: Comply with ASME A13.1, unless otherwise indicated.
 - 3. Shape: As indicated for each piping system.
- J. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.
- K. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
 - 1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.
 - 2. Thickness: 1/16 inch, for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
 - 3. Fasteners: Self-tapping, stainless-steel screws or contact-type permanent adhesive.
- L. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:
 - 1. Green: Cooling equipment and components.
 - 2. Yellow: Heating equipment and components.
 - 3. Brown: Energy reclamation equipment and components.
 - 4. Blue: Equipment and components that do not meet criteria above.
 - 5. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
 - 6. Terminology: Match schedules as closely as possible. Include the following:
 - a. Name and plan number.
 - b. Equipment service.
 - c. Design capacity.
 - d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
 - 7. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.
- M. Plasticized Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with mat finish suitable for writing.
 - 1. Size: 3-1/4 by 5-5/8 inches.
 - 2. Fasteners: Brass grommets and wire.

3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
- N. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in piped utility identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of piped utility systems and equipment.
1. Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.
- 2.6 GROUT
- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 2. Design Mix: 5000-psi, 28-day compressive strength.
 3. Packaging: Premixed and factory packaged.
- 2.7 FLOWABLE FILL
- A. Description: Low-strength-concrete, flowable-slurry mix.
1. Cement: ASTM C 150, Type I, portland.
 2. Density: 115- to 145-lb/cu. ft..
 3. Aggregates: ASTM C 33, natural sand, fine.
 4. Admixture: ASTM C 618, fly-ash mineral.
 5. Water: Comply with ASTM C 94/C 94M.
 6. Strength: 100 to 200 psig at 28 days.

PART 3 - EXECUTION

3.1 PIPED UTILITY DEMOLITION

- A. Refer to Section 024119 "Selective Structure Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.
1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 2. Piping to Be Abandoned in Place: Drain piping. Fill abandoned piping with flowable fill, and cap or plug piping with same or compatible piping material.
 3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.
 5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 DIELECTRIC FITTING APPLICATIONS

- A. Dry Piping Systems: Connect piping of dissimilar metals with the following:

1. NPS 2 and Smaller: Dielectric unions.
 2. NPS 2-1/2 to NPS 12: Dielectric flanges or dielectric flange kits.
- B. Wet Piping Systems: Connect piping of dissimilar metals with the following:
1. NPS 2 and Smaller: Dielectric couplings or dielectric nipples.
 2. NPS 2-1/2 to NPS 4: Dielectric nipples.
 3. NPS 2-1/2 to NPS 8: Dielectric nipples **or** dielectric flange kits.
 4. NPS 10 and NPS 12: Dielectric flange kits.

3.3 PIPING INSTALLATION

- A. Install piping according to the following requirements and utilities Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping to permit valve servicing.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Select system components with pressure rating equal to or greater than system operating pressure.
- I. Sleeves are not required for core-drilled holes.
- J. Permanent sleeves are not required for holes formed by removable PE sleeves.
- K. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of equipment areas or other wet areas 2 inches above finished floor level.
 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - a. PVC Pipe Sleeves: For pipes smaller than NPS 6.
 - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
- L. Verify final equipment locations for roughing-in.
- M. Refer to equipment specifications in other Sections for roughing-in requirements.

3.4 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and utilities Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- E. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- G. Grooved Joints: Assemble joints with grooved-end pipe coupling with coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- H. Soldered Joints: Apply ASTM B 813 water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B 32.
- I. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- J. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.
- K. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
 - 3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - 5. PVC Nonpressure Piping: Join according to ASTM D 2855.
 - 6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- L. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- M. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- N. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End PE Pipe and Fittings: Use butt fusion.
 - 2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.
- O. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.5 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - 3. Install dielectric fittings at connections of dissimilar metal pipes.

3.6 EQUIPMENT INSTALLATION

- A. Install equipment level and plumb, unless otherwise indicated.
- B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.
- C. Install equipment to allow right of way to piping systems installed at required slope.

3.7 PAINTING

- A. Painting of piped utility systems, equipment, and components is specified in Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.8 IDENTIFICATION

- A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.
 - 1. Stenciled Markers: According to ASME A13.1.
 - 2. Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping.
 - 3. Locate pipe markers on exposed piping according to the following:
 - a. Near each valve and control device.
 - b. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.
 - c. Near locations where pipes pass through walls or floors or enter inaccessible enclosures.
 - d. At manholes and similar access points that permit view of concealed piping.
 - e. Near major equipment items and other points of origination and termination.
- B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.
 - 1. Lettering Size: Minimum 1/4 inch high for name of unit if viewing distance is less than 24 inches, 1/2 inch high for distances up to 72 inches, and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
 - 2. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

- C. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

3.9 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of base.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - 7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Section 033000 "Cast-in-Place Concrete."

3.10 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Section 055000 "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.11 GROUTING

- A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION 330500

SECTION 33 05 13
MANHOLES AND STRUCTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Monolithic concrete manholes with transition to lid frame, covers, anchorage, and accessories.
- B. Modular precast concrete manhole sections with tongue-and-groove joints covers, anchorage, and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

- A. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2003 (Reapproved 2012).
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2013.
- C. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections; 2013.
- D. ASTM C478M - Standard Specification for Precast Reinforced Concrete Manhole Sections [Metric]; 2014.
- E. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals; 2008 (Reapproved 2013).
- F. ASTM C923M - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals [Metric]; 2008b (Reapproved 2013).
- G. Greenbook: Standard Specifications for Public Works Construction; Latest edition as adopted by local jurisdiction.

1.04 SUBMITTALS

- A. Shop Drawings: Indicate manhole locations, elevations, piping sizes and elevations of penetrations.
- B. Product Data: Provide manhole covers, component construction, ladders, features, configuration, and dimensions.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Manhole Sections: Reinforced precast concrete in accordance with ASTM C478 (ASTM C478M), with resilient connectors complying with ASTM C923 (ASTM C923M).
- B. Concrete: As specified in Section 03 30 00.

- C. Reinforcement: Formed steel wire, galvanized finish, wire diameter as indicated on drawings.
- D. Concrete Reinforcement: As specified in Section 03 30 00.

2.02 COMPONENTS

- A. Lid and Frame: ASTM A 48/A 48M, Class 30B Cast iron construction, machined flat bearing surface, removable lockable lid, closed lid design; live load rating of 2000 psf (9.576 kPa); sealing gasket; lid molded with identifying name.
- B. Manhole Steps: Formed galvanized steel rungs; 3/4 inch (19 mm) diameter. Formed integral with manhole sections.
- C. Strap Anchors: Bent steel shape, 3 x 24 inch (150 x 610 mm) size x 1/4 inch (6 mm) thick, galvanized to ASTM A 123/A 123M, Grade specified for applicable material category.

2.03 CONFIGURATION

- A. Shaft Construction: Concentric with concentric cone top section; lipped male/female dry joints; sleeved to receive pipe sections.
- B. Shape: Cylindrical.
- C. Clear Inside Dimensions: As indicated.
- D. Design Depth: As indicated.
- E. Clear Lid Opening: As indicated.
- F. Pipe Entry: Provide openings as indicated.
- G. Steps: As indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify items provided by other sections of work are properly sized and located.
- B. Verify that built-in items are in proper location, and ready for roughing into Work.
- C. Verify excavation for manholes is correct.

3.02 PREPARATION

- A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

3.03 MANHOLES

- A. Place concrete base pad, trowel top surface level.
- B. Place manhole sections plumb and level, trim to correct elevations, anchor to base pad.
- C. Form and place manhole cylinder plumb and level, to correct dimensions and elevations. As work progresses, build in fabricated metal items.
- D. Cut and fit for pipe.
- E. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour as required.
- F. Set cover frames and covers level without tipping, to correct elevations.
- G. Coordinate with other sections of work to provide correct size, shape, and location.

3.04 SCHEDULES

- A. Storm Sewer Manholes: Precast concrete sections, galvanized steel steps, 48 inch (1200 mm) inside dimension, to depth indicated, with bolted lid.
- B. Electric Service Manholes: Prefabricated FRP sections, integral molded steps, 60 inch (1500 mm) inside dimension, to depth indicated.

END OF SECTION

SECTION 33 11 16
SITE WATER DISTRIBUTION PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe and fittings for site water lines including domestic water lines and fire water lines.
 - 1. Site water lines up to approximately 5 feet from the building perimeter. See individual building systems for continuation.
- B. Valves.

1.02 RELATED REQUIREMENTS

- A. Section 21 13 13 - Fire Suppression System: Underground fire line extension into the building.
- B. Division 22 - Plumbing: Underground water line extension into the building.
- C. Section 31 23 16 - Excavation: Excavating of trenches.
- D. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.
- E. Section 31 23 23 - Fill: Bedding and backfilling.
- F. Section 33 05 13 - Manholes and Structures.
- G. Section 33 13 00 - Disinfecting of Water Utility Distribution: Disinfection of site service utility water piping.

1.03 REFERENCES

- A. ASTM D1785 - Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2012.
- B. ASTM D2241 - Standard Specification for Polyvinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series); 2009.
- C. ASTM D2466 - Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40; 2013.
- D. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Polyvinyl Chloride (PVC) Pipe and Fittings; 1996 (Reapproved 2010).
- E. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals; 1998 (Reapproved 2011).
- F. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; American Water Works Association; 2010 (ANSI/AWWA C105/A21.5).
- G. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; American Water Works Association; 2012 (ANSI/AWWA C111/A21.11).
- H. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; American Water Works Association; 2009 (ANSI/AWWA C151/A21.51).
- I. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service; American Water Works Association; 2009.
- J. AWWA C504 - Rubber Seated Butterfly Valves, 3 In. (75 mm) Through 72 In. (1,800 mm); American Water Works Association; 2010.

- K. AWWA C508 - Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS; American Water Works Association; 2011 (ANSI/AWWA C508).
- L. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances; American Water Works Association; 2010 (ANSI/AWWA C600).
- M. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution; American Water Works Association; 2007 (ANSI/AWWA C900/C900a).
- N. Greenbook: Standard Specifications for Public Works Construction; Latest edition as adopted by local jurisdiction.
- O. NFPA - National Fire Protection Association.
- P. NFPA 13 - Standard for the Installation of Sprinkler Systems; 2013, as amended in 2013 CBC Referenced Standards.
- Q. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances; 2013; 2013, as amended in 2013 CBC Referenced Standards.
- R. UL 246 - Hydrants for Fire-Protection Service; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.
- B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

- A. Product Data: Provide data on pipe materials, pipe fittings, joints, couplings, valves and accessories.
- B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
 - 1. Submit a certificate stating that the meters have been tested and that the accuracy and capacity meet the requirements of AWWA C700 when tested in accordance with AWWA C705.
- C. Shop Drawings: Submit shop drawings for potable water system, showing piping materials, size, locations, and elevations. Include details of underground structures, connections, thrust blocks, and anchors. Show interface and spatial relationship between piping and proximate structures.
- D. Certificates: Provide a NFPA Certificate of installation with copies for Owner, Architect, local fire officials, and DSA.
- E. Project Record Documents:
 - 1. Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.
 - 2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
 - 3. On a set of Contractor Drawings, kept at the site during construction, mark construction that is installed differently from that indicated.

- a. Locate materials installed underground by dimensions from fixed identifiable points whether installed as indicated or not.
- F. Maintenance Data:
 - 1. Submit maintenance data and parts list for potable water system materials and products.
 - 2. Include this data, product data, shop drawings, and record drawings in maintenance manual; in accordance with requirements of Section 01 78 00 - Closeout Submittals.

1.06 QUALITY ASSURANCE

- A. Perform Work in accordance with utility company requirements.
- B. Manufacturer's Qualification: Firms regularly engaged in manufacture of potable water system materials and products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- C. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with potable water piping work similar to that required for project.

1.07 REGULATORY REQUIREMENTS

- A. Materials and installation shall be in accordance with the following documents hereinafter referred to as the "Standard Specifications".
 - 1. Standard Specification for Public Works Construction, Latest Adopted Edition including Regional and local amendments.
- B. Comply with NFPA 24 as adopted by authority having jurisdiction.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store valves in shipping containers with labeling in place.
- B. Do not store materials directly on the ground. Support the pipe uniformly during shipping and storage.
 - 1. Do not stack higher than 4 feet nor stack with weight on bells.
 - 2. Cover plastic pipe to protect it from sunlight.
 - 3. Keep inside of pipe and fittings free of dirt and debris.
 - 4. Avoid scratching the pipe surface.
- C. Do not install pipe that is cracked, broken, gouged, scratched or forming a clear depression. Remove damaged pipe from the site.
- D. Do not install pipe contaminated with a petroleum product or any other toxic material whether inside or outside of pipe.
- E. Take special care to avoid injury to coatings and linings on pipe and fittings; make satisfactory repairs if coatings or linings are damaged.
 - 1. Hoist pipe with mechanical equipment using a cloth belt sling or a continuous fiber rope which avoids scratching the pipe.
 - 2. Pipes may be lowered by rolling on two ropes controlled by snubbing.

PART 2 PRODUCTS

2.01 SITE FIRE LINE SYSTEM DESCRIPTION

- A. CFC 508 and 901 with NFPA Compliance: Install fire water systems in accordance with NFPA 24 "Standard for Installation of Private Fire Service Mains and Their Appurtenances".
 - 1. Coordinate installation with sprinkler risers at building to match requirements with NFPA 13.
- B. Local Fire Department/Fire Marshal Regulations: Comply with governing regulations pertaining to hydrants, including hose unit threading and similar matching of connections.
- C. UL Compliance: Provide fire hydrants that comply with UL 246 "Hydrants for Fire-Protection Service", and are listed by UL, and approved by the authorities having jurisdiction.

2.02 WATER PIPE

- A. General:
 - 1. Provide piping materials and factory-fabricated piping products of size, type, pressure ratings, and capacities as indicated.
 - 2. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements.
 - 3. Provide size and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in potable water systems.
 - 4. Where more than one type of materials or products are indicated, selection is Installer's option.
- B. Piping:
 - 1. Provide pipes of one of the following materials, of weight/class indicated.
 - 2. Provide pipe fittings and accessories of same material and weight/class as pipes, with joining method as indicated.
- C. Ductile Iron Pipe: AWWA C151:
 - 1. Fittings: Ductile iron, standard thickness.
 - a. Ductile-iron, AWWA C110; asbestos-cement couplings.
 - 2. Joints: AWWA C111, rubber gasket with rods, conforming to ASTM D 1869.
 - 3. Jackets: AWWA C105/A21.5 polyethylene jacket.
- D. PVC Pipe: ASTM D 1785, Schedule 80 for sizes 1/2 inch through 3 inches.
 - 1. Fittings: ASTM D 2466, PVC, socket type, solvent cement joints; or elastomeric gaskets joints.
 - 2. Joints: ASTM D2855, solvent weld.
- E. PVC Pipe: AWWA C900 Class 150 for sizes 4 inches through 12 inches:
 - 1. Fittings: AWWA C111, ductile-iron, cement lined, with rubber gaskets.
 - 2. Joints: Bell and spigot, ASTM D 3139 compression gasket ring.
- F. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with " Water Service " in large letters.

2.03 VALVES

- A. Valves: Manufacturer's name and pressure rating marked on valve body.
- D. Ball Valves Up To 3 Inches (50 mm):
 - 1. Brass body, teflon coated brass ball, rubber seats and stem seals, Tee stem pre-drilled for control rod, AWWA inlet end, compression outlet with electrical ground connector, with control rod, valve key, and extension box.
- G. Valve Ends: Provide flanged, threaded, hub or sleeve type mechanical joint ends designed to suit pipe or tapping sleeves connections.

2.05 BEDDING AND COVER MATERIALS

- A. Bedding: As specified in Section 31 23 16.13.
- B. Cover: As specified in Section 31 23 16.13.

2.06 ACCESSORIES

- A. Anchorages: Provide anchorages for tees, wyes, crosses, plugs, caps, bends, valves, and hydrants. After installation, apply full coat of asphalt or other acceptable corrosion-retarding material to surfaces of ferrous anchorages.
 - 1. Clamps, Straps, and Washers: Steel, ASTM A506.
 - 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.
- B. Concrete for Thrust Restraints: Concrete type specified in Section 03 30 00.
- C. Backflow Preventer: Detector check assembly
 - 1. Reduced-pressure-principle assembly consisting of shutoff valves on inlet and outlet and strainer on inlet. Assemblies shall include test cocks and pressure-differential relief valve located between 2 positive seating check valves and comply with requirements of ASSE Standard 1013. Assemblies shall have approval of Health Department having jurisdiction.
 - 2. Manufacturer: Subject to compliance with requirements, provide identification markers of one of the following (pending approval of local water authority having jurisdiction):
 - a. Cla-Val Co.
 - b. Febco
 - c. Hersey Products, Inc.
 - d. Watts Regulator Co.
 - e. Basis of Design: Zurn Industries Inc. Wilkins Regulators Div.: Wilkins Model 375ADA Reduced Pressure Detector Assembly: www.zurn.com.
 - 3. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Meter:
 - 1. Comply with AWWA C700. Acceptable manufacturers, or equal.
 - 2. Acceptable manufacturers:
 - a. Western Water Meter Inc.
 - b. Rockwell International Corp.

- c. Hersey Products Inc.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- 3. Water meter shall be:
 - a. Flanged multi-jet turbine type.
 - b. Meet requirements of local water department.
- 4. The meter housing shall be bronze with brass case and lid.
- 5. Meter chamber shall be molded and corrosion resistant and shall have a sapphire rotor bearing. The meter register shall be vacuum sealed in copper housing with magnetic coupling. It shall have a leak indicator and heat tempered glass.
- 6. Concrete Meter Box: Meter boxes shall be Brooks Concrete Works Series 3 through 37 meter box, standard meter vault or 300 Series meter vault, or equal, as required by local water department.
- E. Identification
 - 1. Underground-Type Plastic Line Marker: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide blue tape with black printing reading "CAUTION WATER LINE BURIED BELOW".
 - a. Manufacturer: Subject to compliance with requirements, provide identification markers of one of the following:
 - 1) Allen Systems Inc.
 - 2) Seton Name Plate Corp.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Nonmetallic Piping Label: If nonmetallic piping is used for water service, provide engraved plastic laminate, label permanently affixed to main electrical meter panel stating "THIS STRUCTURE HAS A NONMETALLIC WATER SERVICE".
- F. Manhole and Cover: Refer to Section 33 05 13.
- G. Corrosivity Protection: All underground metallic pipe and fittings shall be protected against corrosive soil by wrapping with 8 mil minimum polyethylene sheet.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that building service connection and municipal utility water main size, location, and invert are as indicated.
- B. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 PREPARATION

- A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare pipe connections to equipment with flanges or unions.

3.03 TRENCHING

- A. See the sections on excavation and fill for additional requirements.

- B. Hand trim excavation for accurate placement of pipe to elevations indicated.
- C. Form and place concrete for pipe thrust restraints at each change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Provide 4 sq ft (1.5 sq m) thrust restraint bearing on subsoil.
- D. Do not backfill until installation has been approved and as-built drawings are up to date. Promptly install all piping after excavation or cutting for same has been done, so as to keep the excavations open as short a time as possible.
- E. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.04 INSTALLATION - PIPE

- A. General: During back-filling/top-soiling of underground potable water piping, install continuous underground-type plastic line markers located directly over buried lines at 6" to 8" below finished grade.
- B. Maintain separation of water main from sewer piping in accordance with plumbing code.
- C. Group piping with other site piping work whenever practical.
- D. Establish elevations of buried piping to ensure not less than 3 ft (0.9 m) of cover.
- E. Install pipe to indicated elevation to within tolerance of 5/8 inches (20 mm).
- F. Install ductile iron piping and fittings to AWWA C600.
- G. Polyvinyl Chloride Pipe: Install in accordance with manufacturer's installation instructions.
 - 1. Pressure water lines (4 inch (102 mm) and larger): Install in accordance with pipe manufacturers recommendations, or as shown in J-M Installation Guide "Ring-Tite PVC Pipe". Provide thrust blocks as required by "J-M Installation Guide".
- H. Route pipe in straight line.
- I. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- J. Install access fittings to permit disinfection of water system performed under Section 33 13 00.
- K. Slope water pipe and position drains at low points.
- L. Install trace wire 6 inches (150 mm) above top of pipe; coordinate with Section 31 23 16.13.
- M. Provide and install 14 gauge copper "Tracer" wire, continuous for entire length, for all underground non-metallic piping. Secure to piping at alternate joints, at each fitting and at each valve. Locate "Tracer" wire along side pipe, but not under pipe.
- N. Installation of identification: During back-filling/top-soiling of underground water piping systems, install continuous underground-type plastic line marker, located directly over buried line at 6" to 8" below finished grade.

3.05 INSTALLATION - VALVES AND HYDRANTS

- A. Check operation of all valves before installing. Install valves true to line and grade. Install valves in accordance with AWWA 600 and manufacturer's written instructions. Wrap all buried, ferrous metal valves with polyethylene film in conformance with Section 5-4 of AWWA C105.
- B. Set valves on solid bearing.
- C. Install valves as indicated with stems pointing up. Provide valve box over underground valves.

- D. Center and plumb valve box over valve. Set box cover flush with finished grade.
- E. UL/FM-Type Fire Hydrants: Comply with NFPA 24. Install with gate valve and provision for drainage as indicated.
- F. Set hydrants plumb; locate pumper nozzle perpendicular to and facing roadway.
- G. Set hydrants to grade, with nozzles at least 20 inches (500 mm) above ground.
- H. Locate control valve 4 inches (100 mm) away from hydrant.
- I. Provide a drainage pit 36 inches (900 mm) square by 24 inches (600 mm) deep filled with 2 inches (50 mm) washed gravel. Encase elbow of hydrant in gravel to 6 inches (150 mm) above drain opening. Do not connect drain opening to sewer.
- J. Paint hydrants in accordance with Section 09 90 00.
- K. Fire Department Connections: Install in accordance with AWWA 600-82 and manufacturers written instructions.

3.06 INSTALLATION OF WATER METERS

- A. Install water meter in accordance with AWWA 600-82 and/or utility company's installation instructions and requirements. Check operation of all meters before operation. Install in meter boxes where indicated.
- B. Size meter and arrange piping and specialties to comply with utility company's requirements.
- C. Set meter on concrete pad as indicated. Refer to Division 3 for concrete, formwork, and reinforcing requirements.
- D. Mount meter on wall brackets as indicated.

3.07 ROUGH-IN FOR WATER METER

- A. Install rough-in piping and specialties for water meter installation in accordance with utility company's instructions and requirements.

3.08 ANCHORAGE INSTALLATION

- A. Provide anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches.

3.09 INSTALLATION OF BACKFLOW PREVENTER

- A. Install backflow preventers at each connection to mechanical equipment and systems and in compliance with the plumbing code and authority having jurisdiction. Install air cap fitting and pipe relief outlet drain without valves to nearest floor drain. Identify all piping downstream of backflow preventers as "industrial water".
- B. Install pressure-regulating valves with inlet and outlet shutoff valves and balance cock bypass. Install pressure gage on valve outlet.

3.10 CORROSION PROTECTIVE COATING APPLICATION

- A. Steel Pipe or Valve Assemblies:
 - 1. Implement all the following measures:
 - a. Underground steel pipe with rubber gasketed, mechanical, grooved end, or other nonconductive type joints should be bonded for electrical continuity. Electrical continuity is necessary for corrosion monitoring and cathodic protection.

- b. Install corrosion monitoring test stations to facilitate corrosion monitoring and the application of cathodic protection:
 - 1) At each end of the pipeline.
 - 2) At each end of all casings.
 - 3) Other locations as necessary so the interval between test stations does not exceed 1,200 feet.
 - c. To prevent dissimilar metal corrosion cells and to facilitate the application of cathodic protection, electrically isolate each buried steel pipeline per NACE Standard SP0286 from:
 - 1) Dissimilar metals.
 - 2) Dissimilarly coated piping (cement-mortar vs. dielectric).
 - 3) Above ground steel pipe.
 - 4) All existing piping.
 - d. Choose one of the following corrosion control options:
 - OPTION 1
 - 1) Apply a suitable dielectric coating intended for underground use such as:
 - (a) Polyurethane per AWWA C222; or
 - (b) Extruded polyethylene per AWWA C215; or
 - (c) A tape coating system per AWWA C214; or
 - (d) Hot applied coal tar enamel per AWWA C203; or
 - (e) Fusion bonded epoxy per AWWA C213.
 - 2) Apply cathodic protection to steel piping as per NACE Standard SP0169.
 - OPTION 2
 - 3) As an alternative to dielectric coating and cathodic protection, apply a ¾-inch cement mortar coating per AWWA C205 or encase in concrete 3 inches thick, using any type of cement. Joint bonds, test stations, and insulated joints are still required for these alternatives.
 - 2. NOTE: Some steel piping systems, such as for oil, gas, and high-pressure piping systems, have special corrosion and cathodic protection requirements that must be evaluated for each specific application.
- B. Iron Pipe or Valve Assemblies:
- 1. Implement all the following measures:
 - a. Electrically insulate underground iron pipe from dissimilar metals and from above ground iron pipe with insulating joints per NACE Standard SP0286.
 - b. Bond all nonconductive type joints for electrical continuity. Electrical continuity is necessary for corrosion monitoring and cathodic protection.
 - c. Install corrosion monitoring test stations to facilitate corrosion monitoring and the application of cathodic protection:
 - 1) At each end of the pipeline.
 - 2) At each end of any casings.
 - 3) Other locations as necessary so the interval between test stations does not exceed 1,200 feet.
 - d. Choose one of the following corrosion control options:
 - OPTION 1
 - 1) Apply a suitable coating intended for underground use such as:
 - (a) Polyethylene encasement per AWWA C105; or

- (b) Epoxy coating; or
 - (c) Polyurethane; or
 - (d) Wax tape.
 - 2) NOTE: The thin factory-applied asphaltic coating applied to ductile iron pipe for transportation and aesthetic purposes does not constitute a corrosion control coating.
 - 3) Apply cathodic protection to cast and ductile iron piping as per NACE Standard SP0169.
 - OPTION 2
 - 4) As an alternative to coating systems described in Option 1 and cathodic protection, concrete encase all buried portions of metallic piping so that there is a minimum of 3 inches of concrete cover provided over and around surfaces of pipe, fittings, and valves using any type of cement.
- C. Plastic and Vitrified Clay Pipe
- 1. No special precautions are required for plastic and vitrified clay piping placed underground from a corrosion viewpoint.
 - 2. Protect all metallic fittings and valves with wax tape per AWWA C217 or epoxy.
- D. All Pipe or Valve Assemblies:
- 1. On all pipes, appurtenances, and fittings not protected by cathodic protection, coat bare metal such as valves, bolts, flange joints, joint harnesses, and flexible couplings with wax tape per AWWA C217 after assembly.
 - 2. Where metallic pipelines penetrate concrete structures such as building floors, vault walls, and thrust blocks use plastic sleeves, rubber seals, or other dielectric material to prevent pipe contact with the concrete and reinforcing steel.
- E. Concrete
- 1. From a corrosion standpoint, any type of cement may be used for concrete structures and pipe because the sulfate concentration is negligible, 0 to 0.1 percent. (American Concrete Institute (ACI-318) Table 4.3.1)
 - 2. Standard concrete cover over reinforcing steel may be used for concrete structures and pipe in contact with these soils due to the low chloride concentration found onsite. (Design Manual 303: Concrete Cylinder Pipe. Ameron p.65)

3.11 IDENTIFICATION INSTALLATION

- A. During backfilling/top-soiling of underground water piping systems, install continuous underground-type plastic line marker, located directly over buried line at 6 to 9 inches below finished grade.
- B. Attach nonmetallic piping label permanently to main electrical meter panel.

3.12 SERVICE CONNECTIONS

- A. Provide water service to utility company requirements with reduced pressure backflow preventer and water meter with by-pass valves and sand strainer.
- B. Tap water main with size and in location as indicated, in accordance with requirements of City standards.
- C. Connections to Plumbing Systems: Make connections of service laterals to plumbing facilities at a location 5 feet outside the building line as indicated. Connections shall be made utilizing

standard prefabricated adapters installed in accordance with the pipe manufacturer's recommendations.

3.13 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01 40 00.
- B. Test valves for leakage and alignment prior to backfilling.
- C. Conduct piping tests before joints are covered, and after thrust blocks have sufficiently hardened. Fill pipeline 24-hrs. prior to testing, and apply test pressure to stabilize system. Use only potable water.
- D. Pressure test water piping to 200 psi (1380 kPa).
 - 1. PVC Water Pipelines: Test all water lines in accordance with manufacturers recommendations.
 - a. Test pipe in accordance with Division 22 - Plumbing.
 - 2. Increase pressure in 50 psi increments and inspect each joint between increments. Hold at test pressure for one hour, decrease to 0 psi. Slowly increase again to test pressure and hold for one more hour.
 - 3. Test fails if leakage exceeds 2-qts per hour per 100 gaskets or joints, irrespective of pipe diameter.
- E. Fire Department Connections: On-site fire department connections shall be tested by the Contractor as directed by the Fire Department having jurisdiction. Perform all tests in the presence assigned Inspector.
- F. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.
- G. Submit the completed and approved NFPA Certificate as indicated under Submittals in this section.

3.14 CLEANING

- A. Clean and disinfect water-distribution piping as indicated in Section 33 13 00 - Disinfection of Water Distribution Systems.

END OF SECTION

SECTION 33 13 00
DISINFECTING OF WATER UTILITY DISTRIBUTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Disinfection of site domestic water lines and site fire water lines specified in Section 33 11 16.
- B. Disinfection of building domestic water piping specified in Division 22.
- C. Testing and reporting results.

1.02 RELATED REQUIREMENTS

- A. Division 22 - Plumbing; Plumbing Piping: Disinfection of building domestic water piping system.
- B. Section 33 11 16 - Site Water Distribution Piping.

1.03 REFERENCE STANDARDS

- A. AWWA B300 - Hypochlorites; American Water Works Association; 2011 (ANSI/AWWA B300).
- B. AWWA B301 - Liquid Chlorine; American Water Works Association; 2010 (ANSI/AWWA B301).
- C. AWWA B302 - Ammonium Sulfate; American Water Works Association; 2010 (ANSI/AWWA B302).
- D. AWWA B303 - Sodium Chlorite; American Water Works Association; 2010.
- E. AWWA C651 - Disinfecting Water Mains; American Water Works Association; 2005 (ANSI/AWWA C651).

1.04 SUBMITTALS

- A. Test Reports: Indicate results comparative to specified requirements.
- B. Certificate: From authority having jurisdiction indicating approval of water system.
- C. Certificate: Certify that cleanliness of water distribution system meets or exceeds specified requirements.
- D. Disinfection report:
 - 1. Type and form of disinfectant used.
 - 2. Date and time of disinfectant injection start and time of completion.
 - 3. Test locations.
 - 4. Initial and 24-hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
 - 5. Date and time of flushing start and completion.
 - 6. Disinfectant residual after flushing in ppm for each outlet tested.
- E. Bacteriological report:
 - 1. Date issued, project name, and testing laboratory name, address, and telephone number.
 - 2. Time and date of water sample collection.
 - 3. Name of person collecting samples.

4. Test locations.
5. Initial and 24-hour disinfectant residuals in ppm for each outlet tested.
6. Coliform bacteria test results for each outlet tested.
7. Certification that water conforms, or fails to conform, to bacterial standards of County of Riverside.

1.05 QUALITY ASSURANCE

- A. Water Treatment Firm: Company specializing in disinfecting potable water systems specified in this Section with minimum three years documented experience.
- B. Testing Firm: Company specializing in testing potable water systems, certified by governing authorities of California.
- C. Submit bacteriologist's signature and authority associated with testing.

PART 2 PRODUCTS

2.01 DISINFECTION CHEMICALS

- A. Chemicals: AWWA B300, Hypochlorite, AWWA B301, Liquid Chlorine, AWWA B302, Ammonium Sulfate, and AWWA B303, Sodium Chlorite.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that piping system and water well has been cleaned, inspected, and pressure tested.
- B. Schedule disinfecting activity to coordinate with start-up, testing, adjusting and balancing, demonstration procedures, including related systems.

3.02 DISINFECTION

- A. Use method prescribed by the applicable state or local codes, or health authority or water purveyor having jurisdiction, or in the absence of any of these follow AWWA C651.
- B. Provide and attach equipment required to perform the work.
- C. Inject treatment disinfectant into piping system.
- D. Maintain disinfectant in system for 24 hours.
- E. Flush, circulate, and clean until required cleanliness is achieved; use municipal domestic water.
- F. Replace permanent system devices removed for disinfection.
- G. Pressure test system to 120 psi (827 kPa). Repair leaks and re-test.

3.03 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01 40 00.
- B. Test samples in accordance with AWWA C651.

END OF SECTION

SECTION 33 31 11
SITE SANITARY SEWERAGE PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sanitary sewerage system piping and appurtenances from a point 5 feet outside the building to the point of disposal.
- B. Sanitary sewerage drainage piping, fittings, and accessories.
- C. Connection of building sanitary drainage system to municipal sewers.
- D. Cleanout Access.

1.02 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

- A. Supply of connection devices to building piping for placement by this Section.

1.03 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete for cleanout base pad construction.
- B. Section 31 23 16 - Excavation: Excavating of trenches.
- C. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.
- D. Section 31 23 23 - Fill: Bedding and backfilling.
- E. Section 33 05 13 - Manholes and Structures.

1.04 DEFINITIONS

- A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.05 REFERENCE STANDARDS

- A. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984 (Reapproved 2009).
- B. ASTM C425 - Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings; 2004 (Reapproved 2013).
- C. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets; 2012.
- D. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections; 2012.
- E. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2014.
- F. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals; 2008.
- G. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications; 2011.
- H. ASTM D2564 - Standard Specification for Solvent Cements for Polyvinyl Chloride (PVC) Plastic Piping Systems; 2004 (Reapproved 2009).
- I. ASTM D3034 - Standard Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings; 2014.

- J. ASTM D3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals; 2007 (Re-approved 2013)
- K. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe; 2010.
- L. Standard Specifications for Public Works Construction (Greenbook).
- M. City requirements.

1.06 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the installation of sewer line with size, location and installation of service utilities.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.
- C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.07 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating pipe, pipe accessories.
- C. Shop Drawings:
 - 1. For pre-cast concrete sanitary manholes, including frames and covers.
 - 2. Coordination profile drawings showing sanitary sewerage system piping in elevation. Draw profiles at a horizontal scale of not less than 1 inch equals 50 feet and vertical scale of not less than 1 inch equals 5 feet. Indicate pipe and underground structures. Show types, sizes, materials, and elevations of other utilities crossing sewerage system piping.
- D. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Project Record Documents:
 - 1. Submit documents under provisions of Section 01 78 00 - Closeout Submittals.
 - 2. Record location of pipe runs, connections, catch basins, cleanouts, and invert elevations.
 - 3. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.08 REGULATORY REQUIREMENTS

- A. Conform to applicable code for materials and installation of the Work of this section.
- B. Comply with requirements of Uniform Plumbing Code, Health Department, and Authorities having jurisdiction.
- C. Utility Compliance: Comply with local utility regulations and standards pertaining to sanitary sewerage systems.
- D. Environmental Compliance: Comply with applicable portions of local environmental agency regulations pertaining to sanitary sewerage systems.
- E. Permits: Obtain all required permits in name of Owner.

1.09 PROJECT CONDITIONS

- A. Site Information: Perform site survey, research public utility records, and verify existing utility locations. Verify that storm sewerage system piping may be installed in compliance with original design and referenced standards.
 - 1. Locate existing sanitary sewerage system piping and structures that are to be abandoned and closed.

1.10 SEQUENCING AND SCHEDULING

- A. Coordinate connection to public sewer with utility company.
- B. Coordinate with interior building sanitary drainage piping.
- C. Coordinate with other utility work.

PART 2 PRODUCTS

2.01 SEWER PIPE MATERIALS

- A. Provide products that comply with applicable code(s).
- B. General: Provide pipe and pipe fitting materials compatible with each other. Where more than one type of materials or products is indicated, selection is Installer's option.
- C. Plastic Pipe: ASTM D3034, Type SDR35, Polyvinyl Chloride (PVC) material; inside nominal diameter of 4 to 8 inches (100 to 200 mm), bell and spigot style solvent sealed joint end.
 - 1. Solvent Cement: ASTM D2564
 - 2. Gaskets: ASTM F477, elastomeric seal.
 - 3. Pipe Joints: ASTM D3212
- D. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required wyes, bends, cleanouts, reducers, traps and other configurations required.

2.02 PIPE ACCESSORIES

- A. Cleanouts: Provide cast-iron ferrule and countersunk brass cleanout plug, with round cast-iron access frame and heavy-duty, secured, scoriated cast iron cover.
 - 1. Acceptable Manufacturers:
 - a. Ancon, Inc.
 - b. Josam Co.
 - c. Smith (Jay R.) Mfg. Co.
 - d. Wade Div.; Tyler Pipe.
 - e. Zurn Industries, Inc.; Hydromechanics Div.
- B. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with " Sewer Service " in large letters. <<<< is this even possible on a wire jacket
- C. Underground Warning Tapes: Polyethylene plastic tape with metallic core, 6 inches wide by 4 mils thick, solid green in color with continuously printed caption in black letters "CAUTION - SEWER LINE BURIED BELOW."
 - 1. Allen Systems, Inc.; Reef Industries, Inc.
 - 2. Brady (W.H.) Co.; Signmark Div.

3. Calpico, Inc.
 4. Carlton Industries, Inc.
 5. EMED Co., Inc.
 6. Seton Name Plate Co.
 - 7.
- D. Couplings: Rubber or elastomeric compression gasket, made to match pipe inside diameter or hub, and adjoining pipe outside diameter.
1. Gaskets: ASTM C425, rubber for vitrified clay pipe; ASTM C443, rubber for concrete pipe; ASTM C564, rubber for cast-iron soil pipe; and ASTM F477, elastomeric seal for plastic pipe. Gaskets for dissimilar or other pipe materials shall be compatible with pipe materials being jointed.
- E. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required wyes, bends, cleanouts, reducers, traps and other configurations required.
- F. Corrosivity Protection: All underground metallic pipe and fittings shall be protected from corrosive soils by 8 mil minimum polyethylene sheet.

2.03 CLEANOUT MANHOLE

- A. Manholes shall conform to City Standard Drawing and the Greenbook.
- B. Manhole Frames and Covers: ASTM A 536, Grade 60-40-18, heavy-duty, ductile iron, 24-inch inside diameter by 7- to 9-inch riser with 4-inch minimum width flange, and 26-inch-diameter cover, indented top design, with lettering "SANITARY SEWER" cast into cover.
- C. Lid and Frame: Cast iron construction, hinged lid.
1. Nominal Lid and Frame Size: 26 inches (660 mm).
- D. Pre-cast Concrete Manholes: ASTM C 478 pre-cast reinforced concrete, of depth indicated with provision for rubber gasket joints.
1. Base Section: 12-inch minimum thickness for floor slab and 4.125-inch minimum thickness for walls and base riser section, and having a separate base slab or base section with integral floor.
 2. Riser Sections: 4.125-inch minimum thickness; 48-inch diameter, and lengths to provide depth indicated.
 3. Top Section: Eccentric cone type, unless concentric cone or flat-slab-top type is indicated. Top of cone to match grade rings.
 4. Grade Rings: Provide 2 or 3 reinforced concrete rings, of 6 to 9 inches total thickness and match 24-inch diameter frame and cover.
 5. Gaskets: ASTM C 443, rubber.
 6. Steps: Cast into base, riser, and top sections sidewall at 12- to 16-inch intervals.
 7. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.
 8. Channel and Bench: Concrete.
- E. Base Pad: Cast-in-place concrete of type specified in Section 03 30 00, levelled top surface to receive concrete shaft sections, sleeved to receive sanitary sewer pipe sections.

2.04 BEDDING AND COVER MATERIALS

- A. Pipe Bedding Material: As specified in Division 31 - Earthwork and applicable City or County Standards.
- B. Pipe Cover Material: As specified in Division 31 - Earthwork and applicable City or County Standards.

PART 3 EXECUTION

3.01 GENERAL

- A. Perform work in accordance with applicable code(s).

3.02 TRENCHING

- A. See Division 31 - Earthwork for additional requirements.
- B. Hand trim excavation for accurate placement of pipe to elevations indicated.
 - 1. Correct over excavation in accordance with the Section in Division 31.
 - 2. Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.
- C. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.
- D. If during the installation of pipe, the trench material, backfill material is found to be unsuitable, as determined by the Engineer, it shall be removed and replaced by crushed rock as defined by SSPWC 200-2.2 or 200-2.3 except that minimum sand equivalent value shall be 30. Any excess material that is generated by this process shall be disposed of by the Contractor at no additional cost to the Owner.
- E. Bedding:
 - 1. Excavate pipe trench in accordance with the Section in Division 31 for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.
 - 2. Place bedding material at trench bottom, level materials in continuous layer not exceeding 6 inches compacted depth, compact to 95 percent.
 - 3. Maintain optimum moisture content of bedding material to attain required compaction density.

3.03 EXAMINATION

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.
- B. Inspect piping before installation to detect apparent defects. Mark defective materials with white paint and promptly remove from site.
- C. Unless specified otherwise, all buried piping shall have coverage of at least three feet between top of pipe and finished grade.

3.04 INSTALLATION, GENERAL

- A. General Locations and Arrangements: Drawings (plans and details) indicate the general location and arrangement of the underground sanitary sewerage system piping. Location and

arrangement of piping layout take into account many design considerations. Install the piping as indicated, to the extent practical.

- B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's recommendations for use of lubricants, cements, and other installation requirements.
- C. Use fittings for branch connections, except where direct tap into existing sewer or manhole is indicated.
- D. Use proper size increasers and couplings, where different size or material of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited.
- E. Install piping pitched down in direction of flow, at minimum slope of 2 percent, except where indicated otherwise.
 - 1. Place bell ends of piping facing upstream.
- F. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed, by tunneling, jacking, or a combination of both.
- G. No pipe shall be laid in water and all costs for drainage and/or dewatering trenches during construction shall be borne by the Contractor.

3.05 INSTALLATION - PIPE

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.
- B. Pipe Applications for Underground Sanitary Sewers
 - 1. Pipe Sizes 15 inches and Smaller: PVC gasket joint sewer pipe and fittings.
 - 2. Pipe Sizes 1-1/2 to 10 Inches: Hubless cast-iron soil pipe and fittings.
- C. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.
 - 1. Plastic Pipe: Also comply with ASTM D2321.
 - 2. Pipe shall be assembled by hand or by use of a bar and block or by lever puller. No swinging or stabbing shall be permitted. The "popping-on" of joints is expressly forbidden. All bell and spigot type connection shall be marked on the spigot end to indicate full insertion.
- D. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch (3 mm) in 10 feet (3 m).
- E. Connect to building sanitary sewer outlet and municipal sewer system, through installed sleeves.
- F. Install trace wire 6 inches (150 mm) above top of pipe; coordinate with the Section in Division 31 - Earthwork.

3.06 PIPE JOINT CONSTRUCTION AND INSTALLATION

- A. Join and install hubless cast iron soil pipe and fittings, with "Best" or "MG" cast-iron couplings with neoprene gaskets. Stainless steel couplings not acceptable below grade.
- B. Join and install PVC pipe as follows:

1. Pipe and gasketed fittings, joining with elastomeric seals in accordance with ASTM D3312.
 2. Installation in accordance with ASTM D2321.
- C. Join different types of pipe with standard manufactured couplings and fittings intended for that purpose.

3.07 INSTALLATION MANHOLES

- A. Install manholes complete with accessories as indicated. Form continuous concrete or split pipe section channels and benches between inlets and outlet. Set tops of frames and covers flush with finish surface where manholes occur in pavements. Elsewhere, set tops 3 inches above finish surface, unless otherwise indicated.
- B. Place pre-cast concrete manhole sections as indicated, and install in accordance with ASTM C 891.
- C. Provide rubber joint gasket complying with ASTM C 443 at joints of sections.
- D. Apply bituminous mastic coating at joints of sections.

3.08 INSTALLATION - CLEANOUTS

- A. Install cleanouts and extension from sewer pipe to cleanout at grade as indicated. Set cleanout frame and cover in concrete block 18 by 18 by 12 inches deep, except where location is in concrete paving. Set top of cleanout 1 inch above surrounding earth grade or flush with grade when installing in paving.
 1. Provide as shown on plans or as required by UPC.
- B. Form bottom of excavation clean and smooth to correct elevation.
- C. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.
- D. Establish elevations and pipe inverts for inlets and outlets as indicated.
- E. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.09 TAP CONNECTIONS

- A. Make connections to existing piping and underground structures so that finished work will conform as nearly as practicable to the requirements specified for new work.
- B. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch overlap, with not less than 6 inches of 3000 psi 28-day compressive-strength concrete.
- C. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris, concrete, or other extraneous material that may accumulate.

3.10 CLOSING ABANDONED SANITARY SEWERAGE SYSTEM

- A. Abandoned Piping: Close open ends of abandoned underground piping that is indicated to remain in place. Provide sufficiently strong closures to withstand hydrostatic or earth pressure that may result after ends of abandoned utilities have been closed.
 1. Close open ends of concrete or masonry utilities with not less than 8-inch-thick brick masonry bulkheads.

2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Wood plugs are not acceptable.
- B. Abandoned Structures: Remove structure and close open ends of the remaining piping, or remove top of structure down to not less than 3 feet below final grade; fill structure with stone, rubble, gravel, or compacted dirt, to within 1 foot of top of structure remaining and fill concrete.

3.11 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01 40 00.
- B. Perform testing of completed piping in accordance with local authorities having jurisdiction.
- C. Request inspection prior to and immediately after placing bedding.
- D. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.
- E. Interior Inspection: Inspect piping to determine whether line displacement or other damage has occurred.
 1. Make inspections after pipe between manholes and manhole locations has been installed and approximately 2 feet of backfill is in place, and again at completion of project.
 2. All sewer mains constructed and to become part of the public sewer system shall be digitally recorded by the City prior to acceptance of the sewer system for maintenance by the City.
 3. If inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects correct such defects, and reinspect.
 4. If requested by local utility, provide video recording of visual interior inspection.
 5. Reinspect after any corrections.

3.12 CLEANING

- A. Cleaning: Clear interior of piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.
 1. Place plugs in ends of uncompleted pipe at end of day or whenever work stops.
 2. Flush piping between manholes, if required by local authority, to remove collected debris.

3.13 PROTECTION

- A. Protect finished installation under provisions of Section 01 50 00 - Temporary Facilities and Controls.
- B. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 33 41 11
SITE STORM DRAINAGE SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Storm drainage piping, fittings, and accessories.
- B. Connection of drainage system to municipal sewers.
- C. Catch basins, Trench drains, Plant area drains, Paved area drainage, Site surface drainage, Detention tank, and Detention basin.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete for cleanout base pad construction.
- B. Section 31 22 00 - Grading.
- C. Section 31 23 16 - Excavation: Excavating of trenches.
- D. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.
- E. Section 31 23 23 - Fill: Bedding and backfilling.
- F. Section 33 05 13 - Manholes and Structures.

1.03 DEFINITIONS

- A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.04 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
- B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- C. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984 (Reapproved 2014).
- D. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe; 2014.
- E. ASTM C76M - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe [Metric]; 2014.
- F. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets; 2012.
- G. ASTM C443M - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric); 2011.
- H. ASTM D1784 - Standard Specification for Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds; 2011.
- I. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications; 2011.
- J. ASTM D2729 - Standard Specification for Polyvinyl Chloride (PVC) Sewer Pipe and Fittings; 2011.

- K. ASTM D3034 - Standard Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings; 2014.
- L. ASTM D3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals; 2007 (Re-approved 2013).
- M. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe; 2014.
- N. ASTM F2787 - Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers; 2013.
- O. ASTM F2922 - Standard Specification for Polyethylene (PE) Corrugated Wall Stormwater Collection Chambers; 2013e1.
- P. DIN 19580 - Drainage Channels for Vehicular and Pedestrian Areas - Durability, Mass per Unit Area and Evaluation of Conformity; 2010.
- Q. Greenbook: Standard Specifications for Public Works Construction; Latest edition as adopted by local jurisdiction.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the installation of storm drainage with size, location and installation of service utilities.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.
- C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.06 SUBMITTALS

- A. Product Data: Provide data indicating pipe, pipe accessories.
- B. Shop Drawings:
 - 1. For pre-cast concrete manholes, including frames and covers.
 - 2. For cast-in-place concrete or field-erected masonry sanitary manholes, including frames and covers.
 - 3. Coordination profile drawings showing drainage system piping in elevation. Draw profiles at a horizontal scale of not less than 1 inch equals 50 feet and vertical scale of not less than 1 inch equals 5 feet. Indicate pipe and underground structures. Show types, sizes, materials, and elevations of other utilities crossing drainage system piping.
 - 4. Detention Tank:
 - a. Provide product data and shop drawings indicating the design capacity, layout, per the manufacturer's product design manual and ASTM F2787.
 - b. Indicate: Depth of perimeter stone above, below, and around chamber,
 - c. A structural evaluation by a registered structural engineer that demonstrates that the load factors specified in the AASHTO LRFD Bridge Design Specifications, Section 12.12 are met.
 - 1) The 50-year creep modulus data specified in ASTM F2922 must be used as a part of the AASHTO structural evaluation to verify long-term performance.
 - d. All design specifications for chambers shall be in accordance with the manufacturer's latest design manual.

- C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- D. Project Record Documents:
 - 1. Record location of pipe runs, connections, catch basins, cleanouts, and invert elevations.
 - 2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.07 REGULATORY REQUIREMENTS

- A. Conform to applicable code for materials and installation of the Work of this section.
- B. Comply with requirements of California Plumbing Code and Authorities Having Jurisdiction.
- C. Utility Compliance: Comply with local utility regulations and standards pertaining to storm drainage systems.
- D. Environmental Compliance: Comply with applicable portions of local environmental agency regulations pertaining to storm drainage systems.

1.08 PROJECT CONDITIONS

- A. Site Information: Perform site survey, research public utility records, and verify existing utility locations. Verify that storm drainage system piping may be installed in compliance with original design and referenced standards.
 - 1. Locate existing storm drainage system piping and structures that are to be abandoned and closed.

1.09 SEQUENCING AND SCHEDULING

- A. Coordinate connection to public storm sewer with utility company.
- B. Coordinate with interior building storm drainage piping.
- C. Coordinate with other utility work.

PART 2 PRODUCTS

2.01 DRAINAGE PIPE MATERIALS

- A. Provide products that comply with applicable code(s).
- B. Concrete Pipe: Reinforced, ASTM C76 (ASTM C76M), Class IV with Wall type A; mesh reinforcement; inside nominal diameter of 18 to 24 inches (460 to 610 mm), bell and spigot end joints.
- C. Reinforced Concrete Pipe Joint Device: ASTM C443 (ASTM C443M) rubber compression gasket joint.
- D. Plastic Pipe: ASTM D3034, SDR 35, Type PSM, Polyvinyl Chloride (PVC) material; inside nominal diameter of 4-15 inches (100 to 380 mm), bell and spigot style solvent sealed joint end.
 - 1. Bell and spigot style, push on joints and molded rubber gaskets
 - 2. Maximum pipe length 20 feet.
- E. Plastic Pipe: ASTM D 3034, Type PSM, SDR 35 Polyvinyl Chloride (PVC) material; inside nominal diameter of 4 to 15 inches (100 to 380 mm).
 - 1. Bell and spigot style, push on joints and molded rubber gaskets

2. Maximum pipe length 20'.
- F. Plastic Pipe: ASTM D 679, Polyvinyl Chloride (PVC) material; inside nominal diameter of 18 to 27 inches (457 to 686 mm).
 1. Bell and spigot style, push on joints and molded rubber gaskets
 2. Maximum pipe length 20 feet.
- G. Refer to Drawings for additional information.

2.02 PIPE ACCESSORIES

- A. Pipe Joints: Mechanical clamp ring type, stainless steel expanding and contracting sleeve, neoprene ribbed gasket for positive seal.
- B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required wyes, bends, cleanouts, reducers, traps and other configurations required.
- C. Filter Fabric: Non-biodegradable, woven. Provide 315ST manufactured by Advanced Drainage Systems, Inc.: www.ads-pipe.com.
- D. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with " Storm Drain " in large letters.

2.03 CATCH BASIN, TRENCH DRAIN, CLEANOUT, AND AREA DRAIN COMPONENTS

- A. Reinforced cast-in-place concrete, nominal shaft dimension as indicated on Drawings.
- B. Lids and Drain Covers: Cast iron, hinged to cast iron frame.
 1. Catch Basin:
 - a. Lid Design: Linear grill.
 - b. Nominal Lid and Frame Size: As indicated on Drawings.
 2. Cleanout:
 - a. Lid Design: Checkerboard grill.
 - b. Nominal Lid and Frame Size: As indicated on Drawings.
 3. Area Drain:
 - a. Lid Design: Linear grill.
 - b. Nominal Lid and Frame Size: As indicated on Drawings.
- C. Sediment Filter: Provide sediment filter compliant with BMP practice for NPDES II, as indicated on Drawings.
 1. Product: Storm Water Sediment Control Grate Insert manufactured by Transpo Industries, Inc.: www.transpo.com
- D. Drain Basin for Drainage Retention System:
 1. General
 - a. PVC surface drainage inlets shall include the drain basin type as indicated on the contract drawing and referenced within the contract specifications.
 - b. The ductile iron grates for each of these fittings are to be considered an integral part of the surface drainage inlet and shall be furnished by the same manufacturer.
 - c. The surface drainage inlets shall be as manufactured by Nyloplast a division of Advanced Drainage Systems, Inc., or prior approved equal.
 2. Materials

- a. Drain Basins: PVC pipe stock, utilizing a thermoforming process to reform the pipe stock to the specified configuration.
 - b. Drainage Pipe Connection Stubs: PVC pipe stock and formed to provide a watertight connection with the specified pipe system.
 - c. Joints: Conform to ASTM D3212 for joints for drain and sewer plastic pipe using flexible elastomeric seals.
 - 1) The flexible elastomeric seals shall conform to ASTM F477.
 - 2) The pipe bell spigot shall be joined to the main body of the drain basin or catch basin.
 - d. Surface Drainage Inlets Main Body and Pipe Stubs: Conform to ASTM D1784 cell class 12454.
 - e. The grates and frames furnished for all surface drainage inlets shall be ductile iron.
 - 1) Fabricate specifically for each basin so as to provide a round bottom flange that closely matches the diameter of the surface drainage inlet.
 - 2) Grates for drain basins shall be capable of supporting various wheel or live loads as indicated by location.
 - (a) H-20.
 - 3) 12 inch (300 mm) and 15 inch (380 mm) square grates will be hinged to the frame using pins.
 - 4) Ductile iron used in the manufacture of the castings shall conform to ASTM A536 grade 70-50-05.
 - 5) Grates and covers shall be provided painted black.
- E. Trench Drain System: Trench drain system assembled from factory fabricated, polymer concrete castings in standard lengths and variable depths, with integral joint flanges and integral grating support rails; includes joint gaskets and grating.
- 1. Basis of Design: ACO Polymer Products, Inc., KlassikDrain; Model as indicated on Drawings: www.aco-online.com.
 - 2. Load Class: DIN 19580, Class E.
 - 3. Grating Material and Style: ADA Standards compliant ductile iron.
 - 4. Basis of Design: ACO Polymer Products, Inc., SlabDrain; Model as indicated on Drawings: www.aco-online.com.
 - 5. Load Class: DIN 19580, Class A.
 - 6. Grating Material and Style: ADA Standards compliant ductile iron.
 - 7. Basis of Design: ACO Polymer Products, Inc., FlowDrain; Model as indicated on Drawings: www.aco-online.com.
 - 8. Load Class: DIN 19580, Class A.
 - 9. ADA Standards compliant.
 - 10. Grating Material and Style: ADA Standards compliant slotted ductile iron.
 - 11. Basis of Design: ACO Polymer Products, Inc., PowerDrain; Model as indicated on Drawings: www.aco-online.com.
 - 12. Load Class: DIN 19580, Class D.
 - 13. Grating Material and Style: ADA Standards compliant slotted ductile iron.

14. Basis of Design: ACO Polymer Products, Inc., ACO Sport; Model System 3000 - Track Trench Drainage: www.aco-online.com.
15. Load Class: DIN 19580, Class A.
16. ADA Compliant.
17. Grating Material and Style: ADA compliant slotted ductile iron.
18. Top Finish: Synthetic Surface, see Section 32 1823.33 - Synthetic Track Surfacing.
19. ADA Compliant.
20. Trench Width: As indicated on Drawings.
21. Trench Section Length: 39 inches (1 m), and 19-1/2 inches (500 mm).
22. Grating Support Rail: Stainless steel.
23. Accessories:
 - a. Oval to round pipe connection.
 - b. Vertical outlet strainer.

2.04 DETENTION TANK / RETENTION BASIN

- A. Storm water/drainage retention chambers are designed to control storm water runoff.
- B. As a subsurface retention system, storm water/drainage retention chambers retain and allow effective infiltration of water into the soil.
- C. As a subsurface detention system, storm water/drainage retention chambers hold and allow for the metered flow of water to an outfall.
- D. Arch shaped underground storm water storage chamber in a gravel pit:
 1. Manufacturer: Stormtech: www.stormtech.com
 - a. Model: SC-740.
 - b. Size (L x W x H): 85.4 x 51.0 x 30.0 inches (2170 x 1295 x 762 mm).
 - c. Chamber Storage / Maximum Installed Storage*: 45.9 / 74.9 cu.ft. (1.3 / 2.12 cu.m)
 *Assumes 6-inch (150 mm) stone above, below and between chambers and 40% stone porosity. The nominal storage volume of all storm water/drainage retention chambers includes the volume of the clean, crushed, angular stone.
 - d. Provide matching end cap.
 2. Live Load Rating: AASHTO LRFD HS-20.
 3. The structural design of the chambers, the structural backfill and the installation requirements shall ensure that the load factors specified in the AASHTO LRFD Bridge Design Specifications, Section 12.12 are met for:
 - a. Long-Duration Dead Loads; and
 - b. Short-duration live loads, based on the AASHTO design truck with consideration for impact and multiple vehicle presence.
 - c. Design shall consider earth and live loads as appropriate for the minimum to maximum specified depth of fill.
 4. Chamber Construction:
 - a. The chamber shall be injection molded of an impact modified polypropylene per ASTM F2418 or polyethylene copolymer per ASTM F2922 to maintain adequate stiffness through higher temperatures experienced during installation and service.

- b. Chambers shall be designed in accordance with ASTM F2787.
 - c. Chambers shall be designed in accordance with ASTM F2418.
 - d. The chamber shall have a continuously curved section profile.
 - e. The chamber shall be open-bottomed.
 - f. The chamber shall incorporate an overlapping corrugation joint system to allow chamber rows of almost any length to be created.
 - 1) The overlapping corrugation joint system shall be effective while allowing a chamber to be trimmed to shorten its overall length.
 - g. Chamber rows shall provide continuous, unobstructed internal space with no internal support panels.
 - h. Chambers shall have forty-eight orifices penetrating the sidewalls to allow for lateral conveyance of water.
 - i. Chamber shall have two orifices near its top to allow for equalization of air pressure between its interior and exterior.
 - j. Chamber shall have both of its ends open to allow for unimpeded hydraulic flows and visual inspections down a row's entire length.
 - k. Chamber shall have 14 corrugations.
 - l. Provide on the top of the chamber a 4-inch (100 mm) diameter inspection port to grade.
 - 1) Product: Nyloplast 12 inch (300 mm) inline drain body with 12 inch (300 mm) solid hinged cover and frame, with concrete collar (4 inch (100 mm) 4 inch (100 mm) thick by minimum 36" cross dimension) with 4 inch (100 mm) schedule 40 screw-in cap. Provide 4 inch (100 mm) schedule 40 PVC pipe into chamber.
5. End Cap Construction
- a. End cap to fit into any corrugation of a chamber, allowing capping of a chamber that has its length trimmed; segmenting rows into storage basins of various lengths.
 - b. Provide saw guides for cutting for various diameters of pipe used to inlet the system.
 - 1) End cap shall have structural capacity to allow cutting an orifice of any size at any invert elevation.
 - c. Curve primary face of each end cap outward to resist horizontal loads generated near the edges of beds.
- E. Geotextile Filter Fabric: Non-biodegradable, non-woven, AASHTO M288 Class 2. Provide Geosynthetics 601T manufactured by ADS Advanced Drainage Systems, Inc.; www.ads-pipe.com.

2.05 BEDDING AND COVER MATERIALS

- A. Bedding: As specified in Section 31 23 16.13.
- B. Cover: As specified in Section 31 23 23.

PART 3 EXECUTION

3.01 TRENCHING

- A. See Section 31 23 16.13 - Trenching for additional requirements.
- B. Hand trim excavation for accurate placement of pipe to elevations indicated.

1. Correct over excavation in accordance with Section 31 22 00 - Grading.
2. Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.
- C. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.
- D. Bedding:
 1. Excavate pipe trench in accordance with Section 31 23 16.13 for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.
 2. Place bedding material at trench bottom, level materials in continuous layer not exceeding 6-inch (150 mm) compacted depth, compact to 90 percent.
 3. Maintain optimum moisture content of bedding material to attain required compaction density.

3.02 PREPARATION

- A. Prior to placement of geosynthetic fabric for drainage basin:
 1. Bottom of drainage tank basin shall be granular well-graded soil/aggregate mixtures. less than 35% fines, compacted in maximum 6-inch (150 mm) lifts to 95% Standard Proctor density. Fill material shall comply with manufacturer's design guidelines.

3.03 EXAMINATION

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.
- B. Inspect piping before installation to detect apparent defects. Mark defective materials with white paint and promptly remove from site.

3.04 INSTALLATION, GENERAL

- A. General Locations and Arrangements: Drawings (plans and details) indicate the general location and arrangement of the underground drainage system piping. Location and arrangement of piping layout take into account many design considerations. Install the piping as indicated, to the extent practical.
 1. Install in accordance with Standard Specifications for Public Works Construction (Greenbook), local standards and soils report.
 2. Install pipe, fittings and accessories in accordance with ASTM D3034 and manufacturer's instructions. Seal joints watertight.
- B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's recommendations for use of lubricants, cements, and other installation requirements.
- C. Use fittings for branch connections, except where direct tap into existing sewer or manhole is indicated.
- D. Use proper size increasers and couplings, where different size or material of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited.
- E. Install piping pitched down in direction of flow, at minimum slope of 2 percent, except where indicated otherwise.

1. Place bell ends of piping facing upstream.
- F. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed, by tunneling, jacking, or a combination of both.

3.05 INSTALLATION - PIPE

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.
- B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.
 1. Plastic Pipe: Also comply with ASTM D2321.
- C. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch (3 mm) in 10 feet (3 m).
- D. Connect to building storm drainage system, foundation drainage system, and utility/municipal sewer system.
- E. Make connections through walls through sleeved openings, where provided.
- F. Install continuous trace wire 6 inches (150 mm) above top of pipe; coordinate with Section 31 23 16.13.

3.06 INSTALLATION - CATCH BASINS, TRENCH DRAINS AND CLEANOUTS

- A. Install cleanouts and extension from storm sewer drain pipe to cleanout at grade as indicated. Set cleanout frame and cover in concrete block 18 by 18 by 12 inches deep, except where location is in concrete paving. Set top of cleanout 1 inch above surrounding earth grade or flush with grade when installing in paving.
 1. Provide as shown on plans or as required by UPC.
- B. Form bottom of excavation clean and smooth to correct elevation.
- C. Form and place cast-in-place concrete base pad, with provision for drainage pipe end sections.
- D. Level top surface of base pad; sleeve concrete shaft sections to receive drainage pipe sections.
- E. Establish elevations and pipe inverts for inlets and outlets as indicated.
- F. Mount lid and frame level in grout, secured to top cone section to elevation indicated.
- G. Drain Basin:
 1. Install per manufacturer's instructions and detail for H-20 traffic rating
 2. The specified PVC surface drainage inlet shall be installed using conventional flexible pipe backfill materials and procedures.
 3. The backfill material shall be crushed stone or other granular material meeting the requirements of Class 1 or Class 2 material as defined in ASTM D2321.
 4. Bedding and backfill for surface drainage inlets shall be well placed and compacted uniformly in accordance with ASTM D2321.
 5. The drain basin body will be cut at the time of the final grade.
 6. No brick, stone or concrete block will be required to set the grate to the final grade height.
 7. For load rated installations, a concrete slab shall be poured under and around the grate and frame.

8. The concrete slab must be installed taking into consideration local soil conditions, traffic loading, and other applicable design factors.

3.07 INSTALLATION - DRAINAGE RETENTION TANK (CHAMBER)

- A. The installation of chambers shall be in accordance with the manufacturer's latest installation instructions.

3.08 TAP CONNECTIONS

- A. Make connections to existing piping and underground structures so that finished work will conform as nearly as practicable to the requirements specified for new work.
- B. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch overlap, with not less than 6 inches of 3000 psi 28-day compressive-strength concrete.
- C. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris, concrete, or other extraneous material that may accumulate.

3.09 CLOSING ABANDONED STORM DRAINAGE SYSTEM

- A. Abandoned Piping: Close open ends of abandoned underground piping that is indicated to remain in place. Provide sufficiently strong closures to withstand hydrostatic or earth pressure that may result after ends of abandoned utilities have been closed.
 1. Close open ends of concrete or masonry utilities with not less than 8-inch-thick brick masonry bulkheads.
 2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Wood plugs are not acceptable.
- B. Abandoned Structures: Remove structure and close open ends of the remaining piping, or remove top of structure down to not less than 3 feet below final grade; fill structure with stone, rubble, gravel, or compacted dirt, to within 1 foot of top of structure remaining and fill concrete.

3.10 CLEANING

- A. Cleaning: Clear interior of piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.
 1. Place plugs in ends of uncompleted pipe at end of day or whenever work stops.
 2. Flush piping between manholes, if required by local authority, to remove collected debris.

3.11 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01 40 00.
 1. Perform testing of completed site piping in accordance with the Uniform Plumbing Code using water or air pressure test.
- B. Interior Inspection: Inspect piping to determine whether line displacement or other damage has occurred.

1. Make inspections after pipe between manholes and manhole locations has been installed and approximately 2 feet of backfill is in place, and again at completion of project.
 2. If inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects correct such defects, and reinspect.
 3. Perform video inspection of all piping prior to final acceptance of work.
 - a. All video operations shall be recorded digitally for playback if required.
 - b. All video inspections will include a detailed narrative identifying exact locations of the installed lines and limits of areas to be re-installed.
- C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

3.12 PROTECTION

- A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

